Vol. 9, No. 19
October 15, 1984

Energy Research Abstracts

Abstracts 37035-39097

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $5.00, foreign $6.25 per copy; annual cumulative index, domestic $16.00, foreign $20.00 per copy. The annual subscription price is $72.00 for domestic subscribers and $90.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

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***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

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Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information, Technical Information Center (TIC) cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ABOUT THE TECHNICAL INFORMATION CENTER

The Office of Scientific and Technical Information, Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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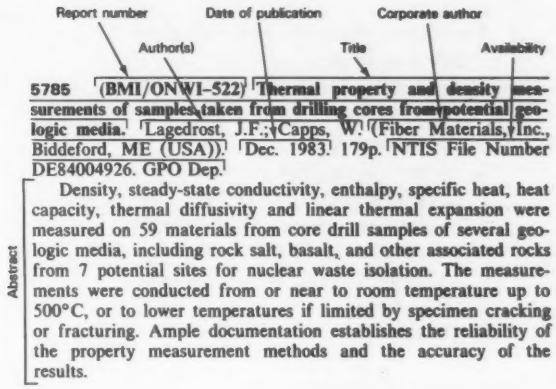
HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
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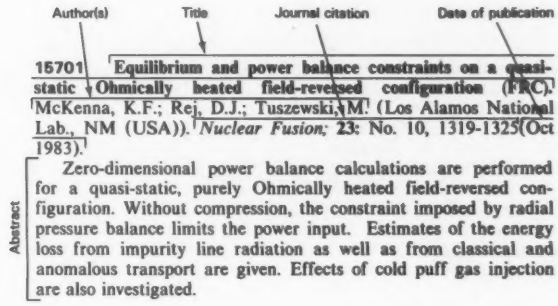
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R:US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J:US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A File Number–Report Number Correlation is included for convenience.

BMI/ONWI-522 9:5785 **NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70**

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

37035 **(NP—4901581) Mineral Resources Institute and Alabama Mining and Mineral Resources Research Institute quarterly report of activities, April 1, 1983-June 30, 1983.** (Alabama Univ., University (USA). School of Mines and Energy Development). 20 Jul 1983. 22p. Mineral Resources Inst., Univ. of Alabama, P.O. Box AY, University, AL 35486. Order Number TI84901581.

Research programs involving coal and oil shales are described briefly. (LTN)

37036 **(NP—4901582) Mineral Resources Institute and Alabama Mining and Mineral Resources Research Institute annual report of activities, October 1, 1982-September 30, 1983.** (Alabama Univ., University (USA). School of Mines and Energy Development). 15 Nov 1983. 44p. Mineral Resources Inst., Univ. of Alabama, P.O. Box AY, University, AL 35486. Order Number TI84901582.

The purpose of the Mineral Resources Institute program is to strengthen education in the mineral and fossil fuel sciences and to stimulate research leading to more effective and efficient utilization of the mineral resources of the state, region, and the nation. In fulfilling this commitment, the Mineral Resources Institute carries out or supports basic and applied research in coal, lignite, oil shale, petroleum, natural gas, metallic ores, and industrial minerals involving chemistry, physics, chemical, metallurgical, mineral, civil engineering, geology, and other specialized disciplines. The Institute consists of a staff of research professionals with backgrounds in geology, mining, metallurgy, mineral processing, and the chemistry and chemical engineering disciplines. The combination of disciplines provides the broad capabilities to conduct programs encompassing geological exploration, mineral resources evaluation, land use, land reclamation, rapid excavation, geochemistry, petrology, hydrology, rock mechanics, mineral processing and extraction, ecology, and health and safety. The research facilities of MRI include laboratories designed for bench scale, fundamental and applied research and development. This report covers significant activities of the Mineral Resources Institute and the Alabama Mining and Mineral Resources Research Institute during the period October 1, 1982 through September 30, 1982.

37037 **(SECV-GO—83-59) Research program: 1983.** Muth Uswamy, V. (State Electricity Commission of Victoria, Melbourne (Australia)). 1983. 123p. State Electricity Commission of Victoria, Melbourne, Australia.

This document contains one project progress report for each of the current research projects (as on 1 January 1983) being carried out by the Research and Development Department of the State Electricity Commission of Victoria. Each report contains a progress statement for the period January to December 1982 and a short term action plan.

0104 Processing

REFER ALSO TO CITATION(S) 01040037099, 37100, 37104, 37118, 37155, 37161, 37163, 37163, 37163, 37164, 37415, 37826

37038 **(CONF-840325—4) Fossil fuel process oils as continuous fluids.** Weil, S.A.; Abbasian-Amin, M.J. (Institute of Gas Technology, Chicago, IL (USA)). 1984. 25p. Inst of Gas Tech., 3424 South State St., Chicago, IL 60616. Order Number TI84901423.

From Winter national meeting of the American Institute of Chemical Engineers; Atlanta, GA, USA (11 Mar 1984).

A procedure to describe the vapor-liquid equilibrium processes involving continuous oils is presented. It considers the oil to consist of a set of fractional oils with distribution functions that, in view of the vapor pressure relationship, maintain their functional forms in equilibrium processes and permit definition of rules of parameter transformation. If the vapor-pressure-boiling point-temperature relationship can be cast in a particular form, then there is an appropriate class of distribution functions that will have the same functional form for a continuous liquid and its equilibrium vapor if both behave as ideal mixtures. The distribution parameters can be related through the vapor pressure expression. A procedure is proposed to describe a continuous oil as a set of fractional continuous oils that have these convenient characteristics. Based on the experimentally determined properties of a shale oil, the procedure when applied to a hypothetical sequence of partial condensations was able to describe the process with reasonable accuracy until less than 1% of the original material was left. The relative error in the distribution functions remains constant throughout the sequence of operations. Thus the accuracy of the method hinges on the accuracy of the first step. In the current application, the parameters and forms of the distribution of the fractional oils were arbitrarily chosen. Future modification of the procedure should include a rationalized method of choosing parameters to achieve closer fit to the original oil. 5 references, 10 figures, 2 tables.

37039 **(DOE/ET/10679—T22) ESCOE Engineering Program. Quarterly report, April 1, 1984-June 30, 1984.** (Engineering Societies Commission on Energy, Inc., Washington, DC (USA)). 1984. Contract AC22-77ET10679. 17p. (FE—2468-112). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014477.

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ESCOE's continuing work consists of: (1) work with PETC to develop and test a Liquefaction Technology Data Base (LTDB) having the highest validity and credibility. (2) Evaluation (with PETC) of experimental results from DOE-funded two-stage liquefaction pilot plants. A particular problem discussed in some detail is the resolution of material and elemental balance problems in ITSL runs 242 through 245 at the Wilsonville plant. (3) The technical feasibility and economics of the TRW Gravimelt, GE Microwave and JPL Chlorinolysis Coal Cleaning processes. Also, the use of such cleaned coals in new or retrofitted boilers, advanced gas turbines and diesel engines. (LTN)

37040 **(DOE/ET/10679—T23) ESCOE engineering program. Quarterly report, October 1-December 31, 1983.** (Engineering Societies Commission on Energy, Inc., Washington, DC (USA)). Jan 1984. Contract AC22-77ET10679. 18p. (FE—2468-110). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014787.

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Flow-rate and analytical measurement problems at the Wilsonville plant have made it difficult to construct accurate material and elemental balances in the ITSL operations, especially in Run 242 which was completed in January 1983. ESCOE's effort, therefore, have focused on resolving the mass and elemental balances of the ITSL configured plant as defined in about 15 material balance workup periods, for Runs 242 and 243. The problem of elemental imbalance on carbon, hydrogen and heteroatoms with the mass-balanced yield structure as originally published for Rums 242 and 243 was recognized by the plant operator. During the summer of 1983 development of a linear-program model to adjust the mass yields to achieve elemental balancing with invariant stream analysis was conducted by the plant operator. This effort led to issuance by SCS of a draft report on Material Balance Procedure on November 30. During December ESCOE has been reviewing this report and

comparing the new yields with ESCOE's adjusted yiields which were based on the measured mass flows and the carbon-hydrogen imbalances around the plant. It was observed that the previously noted sulfur deficiency and hydrogen excess in the products have been substantially corrected, and that the new LP model correctly restates the plants distillate yields at a somewhat lower value. There is still concern over uncertainties in the feed coal analyses for C, H, and O (usually the oxygen appears to be overstated) and the consequent forcing effect on the LP model results. Work on chemical preparation of coal is also reported. (LTN)

37041 **(DOE/ET/10682—13) Investigation of carbon monoxide disintegration of refractories in coal gasifiers. Annual progress report for the period June 1, 1979-May 30, 1980.** Jayatilleke, W.; Martin, C.; Brown, J.J. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Materials Engineering). Apr 1981. Contract AS01-77ET10682. 58p. (FE—2631-13). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015342.

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CO disintegration of high alumina castables is not likely to be a problem in coal gasifiers which operate at or near atmospheric pressure and above 800°C. A 1000 h exposure to a simulated coal gasification atmosphere did not cause any visible damage or strength loss in any castable examined. CO disintegration of high alumina castables is a potential cause of refractory failure at high pressures; the time required for refractory failure rapidly decreases as pressure increases. The effect of even small amounts of iron impurities greatly accelerate the rate of disintegration. In coal gasifiers, CO disintegration is likely to affect the abrasion resistance of the refractories long before any of the more typical signs of CO disintegration appear. The 50% Al_2O_3 castable is more susceptible to abrasion than the 90% Al_2O_3 castable. The temperature range over which CO disintegration is active shifts to higher temperature as pressure increases. Alkali compounds, especially K_2CO_3, have no effect or slightly accelerate CO disintegration of high alumina castables. The 50% Al_2O_3 castable disintegrates faster than the 90% Al_2O_3 castable, possibly a result of the higher iron content of the calcined kaolin used in the 50% Al_2O_3 composition. Stainless steel (AISI 310, 316, and 446) reinforced castables possess very poor resistance to CO disintegation both at atmospheric and 1000 psi pressure.

37042 **(DOE/ET/14700—18) Chemistry and catalysis of coal liquefaction catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1984.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering). May 1984. Contract AC22-79ET14700. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013177.

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Coal-derived liquids are characterized by the presence of a considerable concentration of oxygen-containing components. Therefore, a systematic catalytic hydrodeoxygenation (HDO) study of coal-derived liquids and related model compounds is being carried out. This study provides information not only on the mechanism of HDO as related to the subject of catalytic upgrading of coal-derived liquids, but also on the role of oxygen-containing compounds in primary coal liquefaction processes. The main objective of this research project is to develop effective catalyst systems and processing conditions for hydrodenitrogenation (HDN) of coal-derived liquids (CDL) in a wide range of nitrogen contents and structural type composition. This is of particular importance in view of the higher concentration of nitrogen-containing compounds in CDL as compared to that in petroleum feedstocks. For a better understanding of denitrogenation processes, the project includes systematic denitrogenation studies not only of CDL but also of related model N-containing compounds found in such liquids, e.g., phenanthridine, 1,10-phenanthroline, carbazoles, acridines, etc., as a function of catalysts type and experimental rate, mechanism and stereochemistry of HDN of structurally distinct N-containing aromatic systems in the presence of sulfided catalysts.

37043 **(DOE/ET/14880—T7) Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Twentieth quarterly report, February 16, 1984-May 15, 1984.** Gates, B.C.; Olson, J.H.; Schuit, G.C.A.; Stiles, A.B.; Petrakis, L. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering; Gulf Research and Development Co., Pittsburgh, PA (USA)). 26 Jun 1984. Contract AC22-79ET14880. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013613.

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Kinetics data have been determined for the catalytic hydroprocessing of the acidic fractions of a heavy distillate of a liquid derived from Powhatan No. 5 coal. A commercial, sulfided Ni-Mo/γ-Al_2O_3 catalyst was used in the experiments, carried out at 350°C and 120 atm with the coal liquid fractions dissolved in cyclohexane. The feed and hydrotreated products were analyzed by gas chromatography/mass spectrometry. The data were analyzed with group-type methods for compound classes, and results were also obtained for some individual organooxygen compounds. Catalytic hydroprocessing leads to a large increase in the number of compounds and a shift to lower boiling ranges. The data are broadly consistent with reaction networks determined with pure compounds; the most important reactions include aromatic ring hydrogenation, hydrodeoxygenation, and hydrodemethylation. Pseudo first-order rate constants for conversion of the predominant organooxygen compounds are on the order of 10^{-4} L/(g of catalyst.s); the reactivity decreases in the order cyclohexylphenol > dimethylhydroxyindane > tetrahydronaphthol > phenylphenol > 1-naphthol. 12 references, 15 figures, 5 tables.

37044 **(DOE/FE/55014—T9) Great Plains Coal Gasification Project, Mercer County, North Dakota. Quarterly technical and environmental report, second quarter, 1984.** (Great Plains Gasification Associates, Detroit, MI (USA)). 1984. Contract FM02-82FE55014. 144p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015266.

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Project activities remain on schedule to meet Great Plains Gasification Associates' full gas production date. Detailed engineering is complete for the gasification plant. The only remaining engineering tasks involve field support activities and special projects. Construction is nearly complete. The majority of the remaining tasks involve civil, painting and electrical work. Start-up operations are proceeding very well. Many significant achievements were accomplished during the quarter. Coal was successfully gasified with oxygen. All of the first train's seven gasifiers completed successful production test runs. The only remaining plant permit is the Permit to Operate, which is expected to be issued in late 1985. Quality assurance/quality control activities included major equipment inspections, development of welding procedures and equipment turnover inspections. Freedom Mine development activities remain on schedule.

37045 **(DOE/MC/16050—1601) Survey of screw feeders.** Sine, G. (TRW Energy Engineering Div., Morgantown, WV (USA)). Feb 1983. Contract AM21-81MC16050. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009265.

This report presents the results of a survey to determine the availability of screw feeders for use in areas related to coal feeding in the field of coal conversion. 15 references.

37046 **(DOE/MC/16053—1610) Influence of changing particle structure on the rate of gas-solid gasification reactions. Final report, July 1981-March 1984.** (Vanderbilt Univ., Nashville, TN (USA). Dept. of Chemical Engineering). 4 Apr 1984. Contract AC21-81MC16053. 212p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84011799.

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The objetive of this work is to determine the changes in the particle structure of coal as it undergoes the carbon/carbon dioxide reaction ($C + CO_2 \rightarrow 2CO$). Char was produced by heating the

coal at a rate of 25°C/min to the reaction temperatures of 800°C, 900°C, 1000°C and 1100°C. The changes in surface area and effective diffusivity as a result of devolitization were determined. Changes in effective diffusivity and surface area as a function of conversion have been measured for reactions conducted at 800, 900, 1000 and 1100°C for Wyodak coal char. The surface areas exhibit a maximum as a function of conversion in all cases. For the reaction at 1000°C the maximum in surface area is greater than the maxima determined at all other reaction temperatures. Thermogravimetric rate data were obtained for five coal chars; Wyodak, Wilcox, Cimmeron, Illinois number 6 and Pittsburgh number 6 over the temperature range 800-1100°C. All coal chars exhibit a maximum in reaction rate. Five different models for gas-solid reactions were evaluated. The Bhatia/Perlmutter model seems to best represent the data. 129 references, 67 figures, 37 tables.

37047 **(DOE/MC/20050—T1) Simultaneous high-temperature removal of alkali and particulates in a pressurized gasification system. Second quarterly project report, January 1984-March 1984.** Mulik, P.R.; Alvin, M.A.; Bachovchin, D.M. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 23 May 1984. Contract AC21-83MC20050. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015380.

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In previous programs, emathlite - an inexpensive, readily available mineral - was identified as the leading getter candidate for high-temperature, high-pressure alkali removal in pressurized gasification and PFBC systems. It was also shown that a packed bed getter reactor is the most feasible contacting technique for this hot gas cleaning unit operation. This program represents an attempt to use those findings to develop a packed bed emathlite getter reactor to the stage of readiness for demonstration on a gasification or PFBC system. In addition, one of the program tasks is aimed at more fundamental studies to identify and/or develop alternative or better getter materials. This report summarizes efforts on the five program tasks during the first quarter of 1984. The five tasks include: getter fabrication studies; alkali getter reaction mechanism definition (Si, Al, Ca, Mg, Na, K, Fe, Ti); getter capacity measurements; bench-scale process development unit studies; and engineering definition of hardware requirements for concept scale-up. 2 references, 11 figures, 7 tables.

37048 **(DOE/OR/03054—1-Suppl.) Effects on liquefaction of recycling heavy SRC. SRC-I quarterly technical report. Supplement July-September 1980.** Kang, D.; Givens, E.N. (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015108.

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To avoid the possibility of solvent shortages in the Demonstration Plant, studies are continuing to determine if recycling SRC will generate an increased yield of recycle solvent and maintain adequate solvent quality for the design plant. We hope also to determine if major operational problems may develop with SRC recycle. The present study used processing mixtures of Kentucky No. 9 coal, solvent, and heavy solvent-refined coal (HSRC). To ascertain the effects of HSRC on coal liquefaction, process runs were made with HSRC/solvent, coal/solvent, and coal/HSRC/solvent. The HSRC was composed of 1% oils, 44% asphaltenes, and 55% preasphaltenes; its hydrogen content was lower than that of the LSRC produced during the same run (5.8 vs. 6.8%). A systematic study of HSRC recycle required the use of solvents with varying properties, so two solvents with different hydrogen contents, creosote oil (CO, hydrogen poor) and hydrotreated creosote oil (HTCO, hydrogen rich) were initially examined. Using both CO and HTCO as solvents clarified many of the results from the HSRC recycle runs. HSRC was found to be highly temperature-sensitive, both alone and as a solvent component in the coal slurry feed. CO has better solvency of HSRC than HTCO, although it contains less donatable hydrogen. These characteristics favor a substantial decrease in optimal process temperature yet drastically improve overall yield distribution. 2 references, 24 tables.

37049 **(DOE/OR/03054—2-Suppl.) SRC-I quarterly technical report: supplement, October-December 1980.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015107.

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Two articles have been entered individually into EDB and ERA; two had been entered previously from other sources. (LTN)

37050 **(DOE/OR/03054—5-Suppl.) SRC-I quarterly technical report. Supplement, July-September 1981.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015103.

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Two articles have been entered individually into EDB and ERA; two had been entered previously from other sources. (LTN)

37051 **(DOE/OR/03054—7-Suppl.) SRC-I quarterly technical report. Supplement, January-March 1982.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015105.

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Both articles in this report have been entered individually into EDB and ERA. (LTN)

37052 **(DOE/OR/03054—8-Suppl.) SRC-I quarterly technical report. Supplement, April-June 1982.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015102.

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Both articles in this report have been entered individually into EDB and ERA. (LTN)

37053 **(DOE/OR/03054—17-Suppl.) SRC-I quarterly technical report. Supplement, January-March 1983.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015100.

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Both articles in this report have been entered individually into EDB and ERA. (LTN)

37054 **(DOE/OR/03054—26-Suppl.) SRC-I quarterly technical report: supplement, April-June 1983.** (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015097.

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Both articles in this report have been entered individually into EDB and ERA. (LTN)

37055 **(DOE/OR/03054—37-Annex-Vol.A) SRC burn test in 700-hp oil-designed boiler. Annex Volume A. Southern Research Institute report. Final technical report.** (Southern Research Inst., Birmingham, AL (USA)). Sep 1983. Contract AC05-78OR03054. 250p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84015193.

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Combustion tests were performed using three forms of Solvent Refined Coal (SRC) as the fuel for a 700 hp oil-designed water-tube boiler at the U.S. Department of Energy (DOE) Pittsburgh Energy Technology Center (PETC). This report contains the results from a program of measurements and analyses performed by Southern Research Institute (SoRI) under contract to the International Coal Refining Company (ICRC). The major ob-

jectives of the work performed by Southern Research Institute were: (1) to characterize the particulate matter resulting from the combustion of Solvent Refined Coal (SRC) and its fuel forms, and (2) to develop estimates of the specific collection areas required for varying levels of collection of fly ash from SRC combustion in electrostatic precipitators. The report contains physical and chemical characterizations of particles collected during the combustion experiments, and a discussion of electrostatic precipitation of SRC fly ash based on performance measurements with a small-scale precipitator and on simulations using a mathematical model. 9 references, 90 figures, 14 tables.

37056 **(DOE/OR/03054—37-Annex-Vol.B) SRC burn test in 700-hp oil-designed boiler. Annex Volume B. DOE-Pittsburgh Energy Technology Center report. Final technical report.** (USDOE Pittsburgh Energy Technology Center, PA; GE/MATSCO, Library, PA (USA)). Sep 1983. Contract AC05-78OR03054. 210p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84015196.

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Solvent Refined Coal (SRC) combustion tests were conducted at the U.S. Department of Energy's Pittsburgh Energy Technology Center. Combustion and flue-gas treatment of three different physical forms of SRC, as well as a No. 6 fuel oil, were evaluated. The three SRC fuels were (1) pulverized SRC Fuel; (2) SRC Residual Fuel Oil; and (3) SRC/Water Slurry. The SRC Residual Fuel Oil was a solution of SRC Fuel dissolved in heated process solvent. Approximately 500 tons of pulverized SRC Fuel and 30,000 gallons of SRC Residual Fuel Oil were combusted in a 700 hp (30 x 130 x 10^6 Btu/hr fuel input) oil-designed watertube package boiler. Sixty four-hour ASME combustion tests with three different SRC fuels were successfully concluded. The principal parameters evaluated were excess air levels and combustion air preheat temperature levels. Extensive data were collected on flue-gas levels of O_2, CO_2, CO, unburned hydrocarbons, SO/sub x/, NO/sub x/, uncontrolled particulates, uncontrolled opacity and carbon content of the flue-gas particulates. Boiler and combustion efficiencies were measured. The particulates were characterized via mass loadings, impactors, in-situ resistivity measurements, ultra-fine sampling, optical large particle sampling, five-stage cyclone sampling and chemical analysis of various cut sizes. A three-field pilot electrostatic precipitator (ESP) containing over 1000 square feet of plate collection area, a reverse air fabric filter pilot dust collector and a commercial pulse-jet fabric filter dust collector were operated at high collection efficiency. The results will be valuable in making recommendations for future tests and will provide a basis for conversion of industrial oil-fired boilers to SRC fuels. 11 references, 20 figures, 29 tables.

37057 **(DOE/OR/03054—37-Annex-Vol.C) SRC burn test in 700-hp oil-designed boiler. Annex Volume C. Boiler emission report. Final technical report.** (WFI Sciences Co., Coraopolis, PA (USA)). Sep 1983. Contract AC05-78OR03054. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015197.

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The Solvent-Refined Coal (SRC) test burn program was conducted at the Pittsburgh Energy Technology Center (PETC) located in Bruceton, Pa. One of the objectives of the study was to determine the feasibility of burning SRC fuels in boilers set up for fuel oil firing and to characterize emissions. Testing was conducted on the 700-hp oil-fired boiler used for research projects. No. 6 fuel oil was used for baseline data comparison, and the following SRC fuels were tested: SRC Fuel (pulverized SRC), SRC Residual Oil, and SRC-Water Slurry. Uncontrolled particulate emission rates averaged 0.9243 lb/10^6 Btu for SRC Fuel, 0.1970 lb/10^6 Btu for SRC Residual Oil, and 0.9085 lb/10^6 Btu for SRC-Water Slurry. On a lb/10^6 Btu basis, emissions from SRC Residual Oil averaged 79 and 78%, respectively, lower than the SRC Fuel and SRC-Water Slurry. The lower SRC Residual Oil emissions were due, in part, to the lower ash content of the oil and more efficient combustion. The SRC Fuel had the highest emission rate, but only 2% higher than the SRC-Water Slurry. Each fuel type was tested under variable boiler operating parameters to determine its effect on boiler emissions. The program successfully demonstrated that the SRC fuels could be burned in fuel oil boilers modified to handle SRC fuels. This report details the particulate emission program and results from testing conducted at the boiler outlet located before the mobile precipitator take-off duct. The sampling method was EPA Method 17, which uses an in-stack filter.

37058 **(DOE/OR/03054—37-Annex-Vol.D) Final technical report: SRC burn test in 700-hp oil-designed boiler. Annex Volume D. Electrostatic precipitator mass train and operating data.** (Wheelabrator-Frye, Inc., Coraopolis, PA (USA). Research and Development Dept.). Sep 1983. Contract AC05-78OR03054. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015195.

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Solvent Refined Coal (SRC) is one of the viable replacement fuels for No. 6 fuel oil in industrial and utility boilers. The Department of Energy funded the International Coal Refining Company (ICRC) to develop and to demonstrate the use of SRC as a practical fuel. Phase II of the project was to burn the SRC fuels in a 700 hp package boiler and to collect emission data from which air pollution control devices could be specified. Wheelabrator-Frye, Inc., APC Division was contracted by ICRC to supply and operate a pilot electrostatic precipitator (ESP). Mass emission testing was performed by WFI Sciences. Particle size tests, particle resistivity, SO/sub x/ measurements, and particulate counting tests were conducted by Southern Research Institute (SoRI). This report is a source document covering the ESP operating data and mass emission data. The data obtained by SoRI is used by SoRI in their computer model to specify full scale design criteria. The testing was performed with four fuel types; No. 6 fuel oil, SRC fuel, SRC residual fuel oil, and SRC-water slurry. All fuels were precipitated quite easily resulting in emission rates below the NSPS standards.

37059 **(DOE/OR/03054—37-Annex-Vol.E) SRC burn test in 700-hp oil-designed boiler. Annex Volume E. Evaluation of fabric filter for particulate emission control. Final technical report.** (Wheelabrator-Frye, Inc., Coraopolis, PA (USA). Research and Development Dept.). Sep 1983. Contract AC05-78OR03054. 157p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015198.

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Three types of Solvent Refined Coal Fuels namely, Pulverized SRC Fuel Solids, SRC Residual Fuel Oil and SRC Fuel Water Slurry were fired, one at a time, in a 700 HP boiler designed for oil firing. The purpose was to demonstrate the suitability of SRC Fuels in serving as an alternative to fuel oil and to evaluate the feasibility of fabric filters for control of emissions from SRC fuel fired boilers. Two types of fabric filters, namely a Pulse Jet, full scale Baghouse and a Reverse Air, pilot scale filter were tested. The Pulse Jet Baghouse was an existing full scale unit with a cloth area of 1924 square feet and a gas flow capacity of approximately 10,000 ACFM at 400°F. The Reverse Air Pilot Filter was a bench scale, portable unit with a cloth area of 1 square foot and a gas flow capacity of up to 6 ACFM at 400°F. This report presents the results of particulate mass emission rates, operating conditions and performance of the two fabric filters. The particulate emissions from all fuel types were easily controlled to less than 0.01 lb/million Btu within normal and conventional working range of the fabric filters and with no special or restrictive operating conditions.

37060 **(DOE/OR/03054—37-Annex-Vol.F) SRC burn test in 700-hp oil-designed boiler. Annex Volume F. Independent test evaluation. Final technical report.** (Combustion Engineering, Inc., Windsor, CT (USA); Babcock and Wilcox Co., Barberton, OH (USA). Utility Power Generation Div.). Sep 1983. Contract AC05-78OR03054. 35p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84015199.

During 1982 and 1983, Phase II of the solvent-refined coal (SRC) burn tests was conducted at the US Department of Energy's Pittsburgh Energy Technology Center (DOE-PETC). Babcock and Wilcox, under contract to International Coal Refining Company (ICRC), was involved in evaluating the combustion facility and test matrix, observing the burn tests, and evaluating the results. The burn tests were conducted over a 5-month period. During the test program, low-ash solvent-refined coal was fired in three different

forms: SRC Fuel, SRC-Water Slurry, and SRC Residual Fuel Oil. The combustion facility was a 700-hp D-type package boiler, using a modified circular burner for the three fuel forms. The objectives of the program were to evaluate combustion characteristics and flue gas treatment of the three forms of SRC and of No. 6 fuel oil, and to assess the potential of the RC fuels as boiler fuels. Overall, the test program was successful; all three forms showed their potential as viable boiler fuels and their ability to replace oil or gas in industrial or utility boilers. In ranking the fuels with respect to handling and combustion, SRC Residual Fuel Oil was the easiest, followed by SRC-Water Slurry and SRC Fuel.

37061 **(DOE/OR/03054—37-Vol.1) SRC burn test in 700-hp oil-designed boiler. Volume 1. Integrated report. Final technical report.** (International Coal Refining Co., Allentown, PA (USA); Southern Co. Services, Inc., Birmingham, AL (USA)). Sep 1983. Contract AC05-78OR03054. 160p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84015190.

This burn test program was conducted during the period of August 1982 to February 1983 to demonstrate that Solvent Refined Coal (SRC) products can displace petroleum as a boiler fuel in oil- and gas-designed boilers. The test program was performed at the U.S. Department of Energy's Pittsburgh Energy Technology Center (PETC). Three forms of SRC (pulverized SRC, a solution of SRC dissolved in process-derived distillates, and a slurry of SRC and water) and No. 6 Fuel Oil were evaluated in the 700-hp (30 x 10^6 Btu/hour) watertube, oil-designed boiler facility at PETC. The test program was managed by the International Coal Refining Company (ICRC) and sponsored by the Department of Energy. Other organizations were involved as necessary to provide the expertise required to execute the test program. This final report represents an integrated overview of the test program conducted at PETC. More detailed information with preliminary data can be obtained from separate reports prepared by PETC, Southern Research Institute, Wheelabrator-Frye, Babcock & Wilcox, and Combustion Engineering. These are presented as Annex Volumes A-F. 25 references, 41 figures, 15 tables.

37062 **(DOE/OR/03054—37-Vol.2) SRC burn test in 700-hp oil-designed boiler. Volume 2. Engineering evaluation report. Final technical report.** (International Coal Refining Co., Allentown, PA (USA); Southern Co. Services, Inc., Birmingham, AL (USA)). Dec 1983. Contract AC05-78OR03054. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84015194.

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Volume 2 of this report gives the results of an engineering evaluation study and economic analysis of converting an existing 560-MW residual (No. 6) oil-fired unit to burn solvent refined coal (SRC) fuel forms. Volume 1 represents an integrated overview of the test program conducted at the Pittsburgh Energy Technology Center. Three SRC forms (pulverized SRC, a solution of SRC dissolved in process-derived distillates, and a slurry of SRC and water) were examined. The scope of modifications necessary to convert the unit to each of the three SRC fuel forms was identified and a capital cost of the necessary modifications estimated. A fuel conversion feasibility study of the boiler was performed wherein boiler modifications and performance effects of each fuel on the boiler were identified. An economic analysis of the capital and operating fuel expenses of conversion of the unit was performed. It was determined that conversion of the unit to any one of the three SRC fuel forms was feasible where appropriate modifications were made. It also was determined that the conversion of the unit can be economically attractive if SRC fuel forms can be manufactured and sold at prices discounted somewhat from the price of No. 16 Fuel Oil. As expected, greater discounts are required for the pulverized SRC and the slurry than for the solution of SRC dissolved in process-derived distillates.

37063 **(DOE/OR/03054—66) Enthalpy studies.** Mathias, P.M.; Stein, F.P. (International Coal Refining Co., Allentown, PA (USA)). Sep 1983. Contract AC05-78OR03054. 70p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014934.

This report describes the evaluation and enhancement of the enthalpy model developed for the SRC-I process (as well as other coal liquefaction processes). The enthalpy model has been described in a previous report (Mathias and Monks, 1982). A key feature of the model is the proposed extended corresponding-states framework, obtained through the introduction of a new parameter, termed the polar parameter. It is usual practice to treat the essentially continuous coal-fluid mixture as a set of pseudocomponents, each defined by a narrow range in normal boiling point. The model developed by Mathias and Monks (1982) characterizes each pseudocomponent with the normal boiling point, specific gravity, and polar parameter. Mathias and Monks found that the model provided an excellent description of existing coal-fluid enthalpy data - if the polar parameter was chosen to best fit the data. However, use of the model in process design requires a predictive method for the polar parameter. ICRC is conducting a program to obtain enthalpy measurements in order to provide verification of the current design conditions for the SRC-I Demonstration Plant and data for developing reliable correlations (Mehta, et al., 1983). A majority of the data has been received, analysis of which is described in this report. Comparison of the model to data on three SRC-I 50°F boiling fractions indicates, again, that the data is well correlated if the optimum value of the polar parameter is used. More importantly, this analysis has provided a reasonable basis to predict the values of the polar parameters for all the pseudocomponents employed in the simulation of the SRC-I process. The proposed model has provided encouraging agreement with experimental data, but final conclusions must await analysis of the entire set of data.

37064 **(DOE/OR/03054—115) Corrosion and materials selection report update non-proprietary version. Final technical report.** Agrawal, P.D. (UOP, Inc., Des Plaines, IL (USA). Process Div.). Jun 1984. Contract AC05-78OR03054. 205p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84015160.

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The revised Baseline design (dated 22 October, 1982) used most of the available information with regard to the corrosion, erosion and materials of construction. This information was collected through various programs conducted at the major coal liquefaction pilot plants, e.g. SRC-1 and SRC-2, H-Coal and EDS, and at various research laboratories. The selection of materials of construction was also based on certain basic assumptions with regard to the plant life and life of each type of equipment. Other selection criteria included various process considerations and economics. In cases where no data on corrosion and erosion was available, past experience, licensors' knowhow and engineering judgement, were utilized in the selection process. Beyond the date of publication of the revised Baseline document, additional data from various pilot plants and lab programs has been made available. On account of continuous review being performed by DOE and their subcontractors and consultants, a number of comments were forwarded to ICRC. These comments and latest developmental programs suggested several improvements in the design. This report consists of the following major sections: A discussion on corrosion/erosion related research and pilot plant programs; the materials selection criterion, including plant and equipment life, and various process considerations, are discussed in detail; copies of the materials diagrams from the Revised Baseline are attached; ICRC response to unresolved materials-related comments is included in the Appendix A; areas of concern and data gaps, with regard to the materials of construction are identified; and recommended areas of future research and development programs are listed.

37065 **(DOE/OR/03054—122) SRC area design considerations. Non-proprietary version.** (Catalytic, Inc., Philadelphia, PA (USA)). Jun 1984. Contract AC05-78OR03054. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015233.

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ICRC requested Catalytic to research, review and analyze their record documents, presently stored at a warehousing facility, (Records Management Associates, 2410 Walnut Street, Philadelphia, PA 19107), and prepare a report outlining the technical con-

cerns, actions taken to offset these concerns, results of these actions, and recommend further investigation, if deemed necessary. This report reviews the fifteen systems or items requested in Work Order XQ-3353. These had been previously listed on ICRC's Critical Technology List, and were subjected to special technical reviews and studies in order to ensure the highest possible level of quality and lowest cost commensurate with the overall risks. The fifteen systems or items are listed, previous work on each is examined and new evaluations and conclusions are drawn.

37066 **(DOE/OR/03054—T2-Suppl.) Effects on liquefaction of recycling light SRC. SRC-I quarterly technical report. Supplement, April-June 1980.** Kang, D. (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015109.

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The rationale for recycling SRC in the SRC-I Demonstration Plant focuses on the need for maintaining process solvent yield and quality. As noted in previous reports, the flow through the scaled-up reactor of the Demonstration Plant will be approximately 10 times faster than that in the Wilsonville Pilot Plant reactor - and a computer study (a sequential kinetic model devised by Air Products) has indicated that the faster rate, in reducing the severity of the reaction, will thereby reduce solvent yield and quality. But the same computer study has also predicted that recycling SRC will generate additional solvent of adequate quality. SRC comes in several different compositions. Typically, in the Phase 0 filtration case, SRC is a mixture of approximately 5% oils, 55% asphaltenes, and 40% preasphaltenes. In the Kerr-McGee case for the Demonstration Plant, a light SRC (LSRC) is generated from the Third Stage Settler and a heavy SRC (HSRC) from the Second Stage Settler. The effects of recycling these fractions, mixtures of LSRC, coal and solvent were run through the Air Products Coal Process Development Unit (CPDU) under conditions simulating those of the Demonstration Plant. The results were: Oil formation increased; the hydrogen content of the oil and other condensed products decreased; the asphaltene yield in the SRC product decreased; light hydrocarbon gas formation (C_1-C_4) increased; the distillation characteristics of the oil changed; and hydroxyl groups in the oil increased. In addition to evaluating the recycling of LSRC and HSRC in regard to SRC conversion and solvent yield, the investigation will study its impact on hydrogen consumption and solvent quality. 11 figures, 17 tables.

37067 **(DOE/OR/03054—T14) Revised SRC-I project baseline. Volume 2.** (International Coal Refining Co., Allentown, PA (USA)). 1984. Contract AC05-78OR03054. 344p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84015163.

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The SRC Process Area Design Baseline consists of six volumes. The first four were submitted to DOE on 9 September 1981. The fifth volume, summarizing the Category A Engineering Change Proposals (ECPs), was not submitted. The sixth volume, containing proprietary information on Kerr-McGee's Critical Solvent Deashing System, was forwarded to BRHG Synthetic Fuels, Inc. for custody, according to past instructions from DOE, and is available for perusal by authorized DOE representatives. DOE formally accepted the Design Baseline under ICRC Release ECP 4-1001, at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 5 November 1981. The documentation was then revised by Catalytic, Inc. to incorporate the Category B and C and Post-Baseline Engineering Change Proposals. Volumes I through V of the Revised Design Baseline, dated 22 October 1982, are nonproprietary and they were issued to the DOE via Engineering Change Notice (ECN) 4-1 on 23 February 1983. Volume VI again contains propriear information on Kerr-McGee Critical Solvent Deashing System; it was issued to Burns and Roe Synthetic Fuels, Inc. Subsequently, updated process descriptions, utility summaries, and errata sheets were issued to the DOE and Burns and Roe Synthetic Fuels, Inc. on nonproprietary Engineering Change Notices 4-2 and 4-3 on 24 May 1983.

37068 **(DOE/OR/03054—T15) SRC-I: revised baseline supplement.** (International Coal Refining Co., Birmingham, AL (USA)). Jul 1984. Contract AC05-78OR03054. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015165.

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The recently submitted Revised SRC-I Project Baseline included 30 months of plant operations. This period is divided into two sub-phases: IIIA and IIIB. Phase IIIA is six months in duration and is defined as Startup and Shakedown of the Demonstration Plant. Phase IIIB is two years in duration and encompasses two years of test operations. The Prime Contract allowed for the possibility of up to three additional years of test operations. This extension, Phase IIIC, was subject to mutual agreement by ICRC and DOE. It was also dependent upon a formal Notice of Buyout and plan for expansion of the Demonstration Plant. Pursuant to DOE instructions, the cash flows associated with Phase IIIC have been prepared consistent with the Revised SRC-I Project Baseline and are herewith included.

37069 **(DOE/OR/03054—T16-Vol.1) Revised SRC-I project baseline. Volume 1.** (International Coal Refining Co., Allentown, PA (USA)). 1984. Contract AC05-78OR03054. 536p. NTIS, PC A23/MF A01; 1; GPO Dep. Order Number DE84015162.

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International Coal Refining Company (ICRC), in cooperation with the Commonwealth of Kentucky has contracted with the United States Department of Energy (DOE) to design, build and operate a first-of-its-kind plant demonstrating the economic, environmental, socioeconomic and technical feasibility of the direct coal liquefaction process known as SRC-I. ICRC has made a massive commitment of time and expertise to design processes, plan and formulate policy, schedules, costs and technical drawings for all plant systems. These fully integrated plans comprise the Project Baseline and are the basis for all future detailed engineering, plant construction, operation, and other work set forth in the contract between ICRC and the DOE. Volumes I and II of the accompanying documents constitute the updated Project Baseline for the SRC-I two-stage liquefaction plant. International Coal Refining Company believes this versatile plant design incorporates the most advanced coal liquefaction system available in the synthetic fuels field. SRC-I two-stage liquefaction, as developed by ICRC, is the way of the future in coal liquefaction because of its product slate flexibility, high process thermal efficiency, and low consumption of hydrogen. The SRC-I Project Baseline design also has made important state-of-the-art advances in areas such as environmental control systems. Because of a lack of funding, the DOE has curtailed the total project effort without specifying a definite renewal date. This precludes the development of revised accurate and meaningful schedules and, hence, escalated project costs. ICRC has revised and updated the original Design Baseline to include in the technical documentation all of the approved but previously non-incorporated Category B and C and new Post-Baseline Engineering Change Proposals.

37070 **(DOE/PC/30209—T8) Solvent tailoring in coal liquefaction. Quarterly report, April-June 1984.** Tarrer, A.R.; Curtis, C.W.; Guin, J.A.; Williams, D.C. (Auburn Univ., AL (USA)). Jul 1984. Contract FG22-80PC30209. 31p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014512.

Although the numerous functions of the solvent during liquefaction are not completely understood, the provision for (and the maintenance of) an effective process solvent is necessary for effective coal liquefaction. In this project, the function of the process solvent regarding vapor-liquid equilibrium, hydrogen donation, and catalyst activity has been explored. In previously reported work, a number of donor compounds were evaluated for their relative efficiency in converting coal to cresol solubles. Attempts to correlate the relative efficiency of the various donor compounds were made on the basis of thermodynamic stability and structural features of the molecules. Currently, work is underway with selected donor compounds to determine if the chemical nature of the compound

influences the product distribution obtained during coal liquefaction as well as affecting the amount of conversion obtained. The product distribution, which is being used to evaluate the liquefaction products, is based upon extraction of the products into different solvents. The products are divided into oil, pentane soluble material; asphaltenes, pentane insoluble, benzene soluble material; preasphaltenes, benzene insoluble, methylene chloride/methanol soluble material; and insoluble organic matter, methylene chloride/methanol insoluble material. The effectiveness of the hydrogen donor solvent will be measured by the amount of higher quality material (oil and asphaltenes) obtained as well as by the amount of coal converted.

37071 **(DOE/PC/30209—T9) Solvent tailoring in coal liquefaction. Quarterly report, July-September 1983.** Tarrer, A.R.; Curtis, C.W.; Guin, J.A.; Williams, D.C. (Auburn Univ., AL (USA). Coal Conversion Lab.). 1983. Contract FG22-80PC30209. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014514.

A series of twenty-three aromatic compounds were ranked for their donor solvent efficacy for the dissolution of Western Kentucky No. 9/14 coal. The transfer of hydrogen from the solvent to the coal fragments, as measured by coal conversion, was examined at three levels of available hydrogen. The hydrogen donors are ranked according to their ability to convert coal to THF solubles. Aromatic analogs of the donors showed little ability to convert coal to THF solubles. Factors which influence hydrogen donation include the presence of heteroatoms or substituents both internal and external to the aromatic or hydroaromatic rings, the degree of hydrogenation, the aromaticity or nonaromaticity of the hydroaromatics, and the presence of five-membered rings. A relationship between heats of formation and hydrogen donor ability is shown for hydroaromatics within two ring or three ring homologous series. A model hydrogen acceptor, benzophenone, is also used to rank donors. No correlation exists in the ranking of hydrogen donors by the model acceptor used in this work and in other experimental studies and that obtained by conversion of Western Kentucky coal at typical liquefaction conditions. 24 references.

37072 **(DOE/PC/40781—T11) Catalytic coal liquefaction. Final technical report, June 1, 1981-May 31, 1984.** Weller, S.W. (State Univ. of New York, Buffalo (USA)). Jul 1984. Contract FG22-81PC40781. 12p. (FE—2013-28). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014631.

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Molybdenum catalysts (both supported and unsupported) have been examined in various stages of preparation and use with respect to BET surface area and low temperature oxygen chemisorption. The results are detailed. X-ray diffraction has been used to characterize ammonium molybdate - after calcination, heated in tetralin under nitrogen and after use in an autoclave. Metal salts have been tested for catalytic effects by heating a tetralin-coal mixture (without hydrogen) at a loading of 1% of the coal. Only ammonium heptamolybdate and stannous chloride had a large incremental effect (based on blank runs with tetralin and catalyst without coal). Differences in liquefaction behavior in tubing bombs and in autoclaves are explained by thermodynamic considerations based on the gas to liquid volume in the two cases. (LTN)

37073 **(DOE/PC/60045—T3) Integration of advanced preparation with coal liquefaction. Third quarterly technical progress report, April 1-June 30, 1984.** Steedman, W.G.; Longanbach, J.R.; Muralidhara, H.S.; Folsom, D.W.; Droege, J.W. (Battelle Columbus Labs., OH (USA)). 24 Jul 1984. Contract AC22-83PC60045. 35p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014522.

The objective of this work is to explore the technoeconomic feasibility of a series of unit operations involving: (1) wet grinding of coal in water; (2) removal of chlorine and sodium, release of undesirable mineral matter, and chemical incorporation, if needed, of a disposable liquefaction catalyst in coal via hot water teatment; (3) oil agglomeration to dewater and deash coal while retaining most of the pyrite; and (4) solvent drying of coal agglomerates to eliminate oxidation of coal, improve coal liquefaction reactivity, save energy and prepare the coal/solvent slurry for liquefaction. An apparatus capable of running five microautoclaves simultaneously has been designed and constructed. The autoclaves are shaken along the long axis to insure good mixing and pressure and temperature can be monitored in each autocalve during the run. Reproducibility experiments indicate that the standard deviation on the conversion to THF solubles is about 2.5 percent. The standard deviations in conversions to preasphaltenes and asphaltenes are much higher. A five-autoclave experiment has confirmed earlier results which indicate that wet grinding and hot-water treatment have little effect on conversion to THF solubles but that oil agglomeration followed by drying in a vacuum oven causes a large increase and oil agglomeration followed by solvent drying causes a significant but smaller increase in conversion. 5 references, 13 figures.

37074 **(DOE/PC/60054—T3) Coal liquefaction: investigation of reactor performance, role of catalysts and PCT properties. Quarterly progress report, April 1-June 30, 1984.** Brainard, A.J.; Shah, Y.T.; Tierney, J.W.; Wender, I.; Bhattacharjee, S.; Joseph, S.; Seshadri, K.S. (Pittsburgh Univ., PA (USA)). 1984. Contract FG22-83PC60054. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014307.

Work is in progress to incorporate in the coal liquefaction simulation program information regarding stability of the steady state if the operating conditions are in a region of multiple steady states. The simulator is also being modified to include kinetic data from existing pilot plant data. The first draft on an analysis of Fischer-Tropsch (F-T) synthesis prepared in the previous quarter was revised during this quarter. The revision has been completed. This part of the report, besides F-T synthesis, includes the Kolbel-Englehardt reaction and Isosynthesis. The first drafts on the Mobil methanol-to-gasoline (MTG) technology and on the synthesis of methanol and the use of methanol as a fuel were prepared during this quarter. The history of methanol production, chemistry of and catalysts in methanol synthesis, kinetics of methanol synthesis in an industrial reactor, current production technologies, methanol from coal, three-phase methanol synthesis and methanol as a fuel are discussed in the section on methanol. The final report on heat of reaction is almost complete. Material and energy balances around the dissolver were done with existing data, and correlations available on coal liquids were compared with the actual experimental data reported by Stephenson (1981). A comparison of the predictions of existing correlations of the vapor pressure of coal liquids and the experimental data reported by Gray and Holder (1982) is being done. 2 references.

37075 **(DOE/PC/60780—T2) Material balance in bench-scale coal liquefaction experiments. Second quarterly technical progress report, November 1, 1983-January 31, 1984.** (Alabama Univ., University (USA)). Jul 1984. Contract FG22-83PC60780. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014181.

Two proedures for the work-up of the coal experiments were devised and tested. It must be recalled that our process involves coal materials in three separate fractions: toluene extractant, liquid clathrate layer, and coal residue. The difficulty in obtaining reliable numbers should not be underestimated. So far, the combined weights of coal-derived materials add to ca. 13 g based on an initial 10 g sample of coal in a typical run. Since both procedures now in use involve many steps, complications result. The procedures are given as Appendices A and B. The major sources of added weight are thought to come from (1) failure to remove all the parent AlR_3-containing material from the liquid clathrate phase, (2) incorporation of AlR_3 or NR_4X into the coal residue, and (3) entrainment of pyridine by the coal residue or by the coal-derived liquids. We are currently searching for a simplified procedure which will give better numbers.

37076 **(DOE/PC/60787—3) Composite-bed reactor for upgrading coal-derived liquids. Quarterly report No. 3, April 1-June 30, 1984.** Crynes, B.L.; Seapan, M. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). 9 Jul 1984. Contract FG22-83PC60787. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014695.

Five experimental runs were conducted as a part of the temperature and catalyst zoned concept. These experiments were con-

ducted at 10.3 MPa (1500 psig), with the bottom zone reactor at 400°C (752°F), LHST of 1.9 h, with 20% (wt) of the catalyst in the top zone and utilizing a variable temperature in the top zone 400 to 500°C (752 to 932°F). Excessive reactor plugging occurred when the top zone was operated at 500°C (932°F). This suggests an upper limit when utilizing the feedstock of 15% (wt) mixture of SRC in a coal liquefaction process solvent, and with a commercial grade catalyst, Armak KF-153-S, a Ni-Mo type. All temperature zoning combinations showed a loss in catalyst activation over the experimental run durations of 72 h. Activity loss was rapid in the first 30 to 40 h and gradual thereafter. This activity loss was caused by carbonaceous material and metals deposition. Increasing the top zone temperature from 400 (752°F) to 450°C (842°F) provided a beneficial effect on HDN and HDM activity. A further temperature increase was detrimental because of excessive coking and possible thermodynamic equilibrium limitations. The one reference run that was conducted for the catalyst zone study utilized 400°C (752°F) in both zones, the same feedstock, catalyst, and operational conditions as reported above. Sample analyses are not yet completed. 7 references, 8 figures, 6 tables.

37077 **(SECV-SO—82-53) Devolatilisation of Victorian brown coal.** Brockway, D.J.; Stacy, W.O. . (State Electricity Commission of Victoria, Melbourne (Australia)). 1982. 41p. State Electricity Commission of Victoria, Melbourne, Australia.

The devolatilisation characteristics of two brown lithotypes (pale and medium dark) were studied at rapid rates of heating. The effects of heating rate variation were studied at final temperatures of 500-1250 degrees C. The results showed that the yield of all products was dependent on the coal lithotype, heating rate and the final temperature reached. The volatile product yields approached 70% of the original mass of dry coal at temperatures of about 1200 degrees C.

37078 **Cleavage of benzylaryl ethers in the presence of zinc halides.** Frederick, T.J.; Bell, A.T. (Lawrence Berkeley Lab., CA). *Journal of Catalysis;* **87**: No. 1, 210-225(May 1984). Contract AC03-76SF00098.

Ether groups constitute one of the primary linkages between aromatic centers present in coal. During the liquefaction of coal under the influence of zinc halides, it is believed that these linkages are cleaved. The details of this process have been studied in the present investigation using benzylphenyl ether (BPE), benzyl-p-tolyl ether (BTE), and benzyl-l-naphthyl ether (BNE) to represent the ether structures present in coal. $ZnCl_2$ and $ZnBr_2$ were used as catalysts. $ZnCl_2$ was found to be catalytically inactive. However, in the presence of HCl it forms a stable adduct which is highly active. $HBr/ZnBr_2$ behaves in a manner analogous to $HCl/ZnCl_2$ but is tenfold more active. All three ethers react in a similar fashion. In each case cleavage occurs at the oxygen-methylene bond and is accompanied by a small degree of ether rearrangement to form the corresponding hydroxydiarylmethane. The reaction kinetics for BPE, BTE, and BNE can be described in terms of a carbocation mechanism. Rate coefficients for each of the elementary steps have been determined by simulation of the experimentally observed product concentration versus time profiles.

37079 **Cleavage of dibenzyl ether in the presence of zinc halides.** Frederick, T.J.; Bell, A.T. (Lawrence Berkeley Lab., CA). *Journal of Catalysis;* **87**: No. 1, 226-237(May 1984). Contract AC03-76SF00098.

The large amount of water liberated during coal liquefaction in the presence of $ZnCl_2$ is believed to derive from the cleavage of benzylic ethers. The details of this process have been studied using dibenzyl ether as a model structure and $ZnCl_2$, $ZnBr_2$, and ZnI_2 as catalysts. The influence of H_2O and HX on the progress of the reaction was also examined. In the absence of HX addition, ZnX_2 activates the ether by forming a Lewis acid-base complex with it. Water interferes with the formation of this complex by competing for ZnX_2. In the presence of HX, an adduct is formed, HX times ZnX_2, that is much more active catalytically than ZnX_2. The presence of water does not influence the activity of the Bronsted acid form of the catalyst. Activation of dibenzyl ether is achieved by protonation of the ether. The relative activity of the zinc halides depends on which of the two forms is present. If anhydrous ZnX_2 is the catalyst, the activity of the zinc halides depends on which of the two forms is present. If anhydrous ZnX_2 is the catalyst, the activity decreases in the order $ZnCl_2 > ZnBr_2 > ZnI_2$. On the other hand, if HX times ZnX_2 is the prevalent form, the activity decreases in the order HI times ZnI_2 > HBr times $ZnBr_2$ > HCl times $ZnCl_2$. It is observed that during the reaction of dibenzyl ether in the presence of ZnX_2, a small amount of HX is liberated, which then combines with ZnX_2 to form HX times ZnX_2. Because the Bronsted acid form of the catalyst is more active than the Lewis form, the apparent activity of the catalyst increases after a period of induction during which HX is generated.

37080 **Failure of Incoloy 800H superheater tubes in Mountain Fuel Resources Gasifier.** Diercks, D.R. (Argonne National Lab., IL). *Materials and Components in Fossil Energy Applications;* No. 49, 1-4(1 Apr 1984).

A failure analysis of the Incoloy 800H superheater tubes in the Mountain Fuel Resources Gasifier is discussed. Chemical analysis indicated that the alloy chemistry was within the specifications for Incoloy 800H and no unusual impurity levels were noted. It was found that cracks initiating in the outer surface of the superheater tubing played the predominate role in the failure.

37081 **Kinetics of short contact time coal liquefaction Part 1: Effect of operating variables.** Abichandani, J.S.; Cronauer, D.C.; Shah, Y.T.; Wieland, J.H. (Dept. of Chemical & Petroleum Eng., Univ. of Pittsburgh, Pittsburgh, PA 15261). *AIChE (American Institute of Chemical Engineers) Journal;* **30**: No. 2, 295-303(Mar 1984).

The liquefaction kinetics of Powhatan No. 5 mine coal (Pittsburgh Seam) in the presence of SRC-II recycle solvent at short contact times (<10 min) and temperature and pressure ranges of 573-723 K and 10.3-13.8 MPa is examined in a well-mixed reactor. In the initial stages of liquefaction, while overall coal conversion (tetrahydrofuran solubles) increases with temperature, oil (pentane solubles) is lost with an increase in temperature. An increase in solvent-to-coal ratio results in an increase of conversion. The initial coal particle size distribution, total pressure, and nature of gas phase (nitrogen or hydrogen) have no significant effect on the production of any of the product of liquefaction for contact times up to 10 min. A lumped kinetic model is presented to describe the product distribution.

37082 **Kinetics of short contact time coal liquefaction Part 11: Effect of nature of coal and solvent.** Abichandani, J.S.; Cronauer, D.C.; Shah, Y.T.; Wieland, J.H. (Dept. of Chemical & Petroleum Eng., Univ. of Pittsburgh, Pittsburgh, PA 15261). *AIChE (American Institute of Chemical Engineers) Journal;* **30**: No. 2, 304-309(Mar 1984).

A bituminous coal (Powhatan No. 5) and a subbituminous coal (Belle Ayr) were liquefied in the presence of hydrogen donor solvents. Statistical analyses of the data showed that for contact times up to 10 min, the coal conversion, measured in terms of tetrahydrofuran solubles, was not significantly different for the two coals. However, the subbituminous coal gave more asphaltenes than the bituminous coal. The hydrogen-donating capacity of the solvent was varied by the addition of hydrogenated phenanthrene to SRC-II recycle solvent. The results indicated that there are two routes for the formation of oils from coal. One is by adduct formation giving asphaltenes and preasphaltenes, which in turn give oils, and the other is direct oil formation from coal. The preferred route depends on the hydrogendonating capacity of the solvent. The kinetic model, proposed in Part I of this paper, is extended to account for the change in the donor capacity of the solvent.

37083 **A status review of direct coal liquefaction technology.** McNeese, L.E.; Cochran, H.D.; Irvine, A.R.; Salmon, R. (Oak Ridge National Laboratory, Oak Ridge, TN). *Alternative Energy Sources;* 438(Dec 1983). (CONF-831205—).

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

Direct liquefaction of coal, which was first practiced in Germany during World War II, has been under further development in the U.S. and elsewhere for more than a decade. This paper reviews the status of the major developing technologies required for oper-

ation of a direct coal liquefaction facility. The subjects addressed include the status of technology of coal dissolution chemistry, coal dissolution reactor design, coal slurry preheaters, high pressure vapor/liquid separators, residue production, product upgrading, slurry pumps, pressure let-down valves, and general instrumentation. In general, it is concluded that the technology is adequate to permit satisfactory performance in the several areas; however, quite substantial improvements are possible in most cases.

37084 **Solvent effects in supercritical extraction of coal.** Vasilakos, N.P.; Dobbs, J.M.; Parisi, A.S. (Department of Chemical Engineering, University of Texas, Austin). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 212-227(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The specific physical and chemical characteristics of supercritical solvents and solvent mixtures that can affect the yield and the properties of coal extracts were experimentally investigated. Strong non-ideal interactions, such as polar forces and hydrogen bonding, as well as synergistic interactions in multicomponent solvent mixtures, were shown to produce large deviations from the simple, densitydriven supercritical solubility. These interactions can be manipulated to optimize supercritical coal extraction by reducing the severity of the extraction conditions (pressure in particular). Physical and chemical changes occuring in the coal structure during supercritical solvent extraction were also examined.

37085 **Supercritical fluid methods for coal extraction, separation, and analysis.** Smith, R.D.; Udseth, H.R.; Wright, B.W. (Chemical Methods and Kinetics Section Pacific Northwest Laboratory Richland, WA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 235-240(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Supercritical fluids are attracting increased interest for media for coal liquefaction and gasification, the basis for new separation techniques, and in new analytical techniques for the separation and characterization of coal-derived products. On-going research at Pacific Northwest Laboratory (PNL) is examining a range of supercritical fluid applications, including their use as a reaction media for coal liquefaction and for separation of fuels and coal-derived products. Other programs at PNL are studying the applications for analysis of fuel samples using supercritical fluid chromatography (SFC), the new technique of direct fluid injection-mass spectrometry (DFI-MS), and their combination (SFC-MS). In this report the authors present an overview of the range of supercritical fluid applicationsat PNL related to coal and fuel separation and characterization.

37086 **The role of thermal chemical processes in supercritical gas extraction of coal.** Squires, T.G.; Aide, T.; Chen, Y.Y.; Smith, B.F. (Energy & Mineral Resources Research Institute Iowa State University, Ames, Iowa 50011). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 228-234(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Many factors which limit the chemical conversion of insoluble, solid coal to soluble, smaller fragments are due to phenomena which are not routinely encountered in the chemical laboratory or in the chemical processing industry. In the first place, it often appears that the rate and extent of coal conversion is controlled by accessibility to reaction sites rather than by reaction energetics. Secondly, the chemical objective, depolymerization, is exactly the reverse of that of a major segment of the present chemical processing industry. While these observations are obvious, the implications for coal conversion are far reaching; and much of our recent research effort has focused on understanding the effects of these phenomena. Problems which limit the efficiency of current coal conversion processes are not necessarily amenable to solution using conventional solvents, standard reactor configurations, or other established chemical conversion concepts. Currently, the authors are investigating supercritical fluids (SCF's) as solvents for extracting and chemically converting coal. The advantages of SCF's as solvents for coal extraction have been recognized for some time. Near the critical temperature, the solvent power, viscosity, and diffusion rates can be manipulated over wide ranges by relatively small changes in pressure or temperature. Thus, SCF's have been touted as solvents which, by suitable manipulation of temperature and pressure, enhance both reagent access to interior reaction sites in coal and product removal from the microporous coal residuum. One of the primary objectives of the present research is to compare the efficacy of subcritical and supercritical solvents in this mass transport function.

37087 **Catalytic hydroliquefaction of low-rank coals.** Guruz, K.; Kranich, W.L.; La Violette, L.J.; Mendes, C. (Department of Chemical Engineering Worcester Polytechnic Institute Worcester, Massachusetts). *Energy Sources (New York);* **7**: No. 1, 1-14(1983).

Hydroliquefaction behavior of α-cellulose, leonardite, four lignites, and two subbituminous coals suspended in an anthracene oil carrier has been investigated in the presence of Co-Mo/Al_2O_3 catalyst at 425°C and at an average pressure of 1,300 psig in a batch reactor for 30-min reaction time. Both total conversion of moisture-ash free solids and total yield of liquid products were greater for all but one of the lignites than for the subbituminous coals. Partial demineralization by HCl washing decreased both the total conversion of and pentane-soluble oil yield from lignites. It had relatively little effect on subbituminous coals. Although cellulose was almost completely converted to liquids and gases, no pentane-soluble oils were produced.

37088 **Removal and treatment of acid gases.** pp 373-408 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Hydroden sulfide is the primary sulfur compound which must be removed from the product stream in coal conversion plants. While carbon dioxide is not classified as a pollutant, it is sometimes desirable to remove CO_2 from the product gas, as well, to improve its heating value. An overview of process alternatives is presented and then individual processes are discussed in greater detail and compared. Amine and carbonate processes are the two most important of the chemical absorption processes. Six alkanolamine processes are mentioned. Described are the DGA (diglycolamine), ADIP, Hot Potassium Carbonate, Catacarb, Benfield, Giammarco-Vetrocoke, MEA, Seaboard, Vacuum Carbonate, and Tripotassium Phosphate processes. Physical absorption processes which are described are: Selexol, Rectisol, Purisol, Fluor Solvent, and Sulfinol processes. Direct liquid phase conversion processes include the Stretford, Takahax, Giammarco-Vetrocoke, Ferrox, Manchester, Thylox, and Townsend processes. Five dry bed absorption processes are summarized: Iron Sponge, Molecular Sieve, Haines, Activated Carbon, and Dolomite Acceptor. The original Claus scheme and a modification which would allow this process to be used in coal conversion plants are described. Tail gas treating, needed for the Claus process, is also discussed. The economics of hydrogen sulfide removal are summarized. 25 references, 14 figures, 5 tables.

37089 **Coal gasification.** pp 133-192 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

After brief reviews of the history and chemistry of coal gasification, the design, operation, and performance of commercial gasifiers are described. Fixed bed gasifiers include the Lurgi, Wellman-Galusha, Wilputte, Riley-Morgan, Woodall-Duckham, Wellman Incandescent, and FW-Stoic. The Koppers-Totzek entrained bed gasifier and the Winkler Fluidized bed gasifier are also described. Second generation gasification processes closest to commercialization are the Slagging Lurgi and Texaco gasification processes. Other second generation processes and their gasifiers are also discussed. These include the Gegas, Kiln Gas (both fixed bed), the Bi-Gas, Babcock and Wilcox, Foster-Wheeler, Combustion Engineering, Shell process (all entrained bed), the CO_2 Acceptor, High Temperature Winkler, Hygas, Synthane, Exxon Catalytic Gasification, U-Gas, Westinghouse, Cogas (all fluidized bed), and the Kellogg, Saarberg-Otto, Atgas, (molten bath). In-situ gasification is discussed: engineering factors, coal properties, geological factors, and operating variables. Upgrading medium Btu gas to a synthetic natural gas is described by discussing the shift reaction and methana-

tion. The chapter is concluded with discussions of the commercialization of coal gasification in the US, syngas economics, and economic studies on coal gasification. 76 references, 13 figures, 9 tables.

37090 **Coal liquefaction.** pp 193-220 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Indirect liquefaction, involving the gasification of the coal followed by chemical processing at high pressure, and direct liquefaction, involving hydrogenation under high pressures, are discussed. The indirect liquefaction process schemes described are Fischer-Tropsch processing, methanol synthesis, and gasoline synthesis. Direct liquefaction processes described are the Solvent Refined Coal, Consol Synthetic Fuels, Exxon Donor Solvent, and H-Coal processes. The chapter also includes information on the chemical composition of coal liquids and the commercialization and economics of synfuel production. 48 references, 8 figures, 13 tables.

37091 **Coal carbonization.** pp 113-132 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Carbonization, destructive distillation, and pyrolysis are all terms used to describe the heating of coal in the absence of air or with limited oxidant. The history of both low-temperature and high-temperature carbonization processes is discussed. Pyrolysis properties of coal, gas yields and composition, yields of chars and tar, temperature effects, and flash pyrolysis are discussed. Low-temperature and high-temperature retorts for commercial carbonization processes are described. Pyrolysis processes which are under development are also described. These include the COED process, Garrett process, Lurgi-Ruhrgas process, Toscoal process, Coalcon process, and CS/R process. Coal tar processing is briefly discussed. 21 references, 6 figures, 3 tables.

37092 **Chemical fractionation and analysis of organic compounds in process streams of low Btu gasifier effluents.** Hanson, R.L.; Royer, R.E.; Benson, J.M.; Carpenter, R.L.; Newton, G.J.; Henderson, R.F. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *ACS Symposium Series;* No. 205, 205-223(1982). Contract AC04-76EV01013.

Low Btu gas must be purified before it will be suitable for use in a turbine. Many cleanup devices have been used on the output stream of the stirred-bed gasifier at the Morgantown Energy Technology Center. Both vapor phase and particulate phase organic compounds were sampled at several locations in the purification process. The results indicate that the complex nature of organic materials is associated with low Btu coal gasification. Several classes of organic compounds were found, including neutral sulfur and nitrogen heterocycles, phenols, and bases, including aza arenes and polycyclic aromatic hydrocarbons. Some of these compounds were not suitable for gas chromatography, so various liquid chromatographic fractionation procedures and pH partitioning were used to separate and characterize these compounds. The NMR spectroscopy also provided information about the structure of the non-volatile organic compounds. The cleanup system removes higher mol wt organic compounds which are mainly aromatic or alkyl substituted aromatic compounds. Diluting and cooling the producer gas produces a respirable aerosol. The polynuclear aromatic hydrocarbons are condensed by the dilution and cooling of the producer gas.

0106 Properties

REFER ALSO TO CITATION(S) 01060037127, 37158, 37163, 38032

37093 **(CMRC—81/37-T) Review of standards for coal moisture determination.** Germain, R.J.; Hinds, J. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Oct 1981. 33p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

Both ASTM and ISO standards for determining coal moisture are recognized in Canada. However, these standards have several significant differences. The ASTM definition of free moisture is not equivalent to the ISO definition. The problems and uncertainties associated with free moisture increase as coal rank decreases. At present, neither definition is suitable for all situations wherein the determination of coal free moisture is required. ASTM has several moisture determination standards, all based on the loss in weight of the coal sample when dried in air. ISO has several standards also, but these standards provide alternate methods that attempt to minimize the errors due to oxidation of low rank coals by the oxygen in air. Results in the scientific literature and the results of tests done specifically for this study indicate that differences of 0.5% absolute can result between ASTM and ISO methods of determining moisture for lower rank coals. For such coals, a nitrogen atmosphere, as recommended by ISO, should be used for the analytical determination of coal moisture.

37094 **(DOE/PC/30013—F10) Data base for the analysis of compositional characteristics of coal seams and macerals. Final report - Part 10. Variability in the inorganic content of United States' coals: a multivariate statistical study.** Glick, D.C.; Davis, A. (Pennsylvania State Univ., University Park (USA). Coal Research Section). Jul 1984. Contract AC22-80PC30013. 425p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84014544.

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The multivariate statistical techniques of correlation coefficients, factor analysis, and cluster analysis, implemented by computer programs, can be used to process a large data set and produce a summary of relationships between variables and between samples. These techniques were used to find relationships for data on the inorganic constituents of US coals. Three hundred thirty-five whole-seam channel samples from six US coal provinces were analyzed for inorganic variables. After consideration of the attributes of data expressed on ash basis and whole-coal basis, it was decided to perform complete statistical analyses on both data sets. Thirty variables expressed on whole-coal basis and twenty-six variables expressed on ash basis were used. For each inorganic variable, a frequency distribution histogram and a set of summary statistics was produced. These were subdivided to reveal the manner in which concentrations of inorganic constituents vary between coal provinces and between coal regions. Data collected on 124 samples from three stratigraphic groups (Pottsville, Monongahela, Allegheny) in the Appalachian region were studied using analysis of variance to determine degree of variability between stratigraphic levels. Most variables showed differences in mean values between the three groups. 193 references, 71 figures, 54 tables.

37095 **(DOE/PC/62690—T4) Evaluation of the effect of coal cleaning on fugitive elements. Phase IV. Identification of mineral forms in coal. Quarterly progress report No. 4, March 1-May 31, 1984.** Streeter, R.C. (Bituminous Coal Research, Inc., Monroeville, PA (USA). National Lab.). 20 Jun 1984. Contract AC22-83PC62690. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015038.

X-ray diffraction analysis of all of the Illinois No. 6 ash samples (2R and 25R series) was completed during this quarter. Efforts will now be concentrated on interpretation of the X-ray data. The scope of the program will also be modified to include samples from the advanced coal cleaning processes of interest to DOE. 2 tables.

37096 **(DOE/PETC/TR—84/9) PETC fuel rheology laboratory.** Ekmann, A.C.; Ekmann, J.M. (USDOE Pittsburgh Energy Technology Center, PA). Aug 1984. 49p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015468.

This document summarizes the results of investigations into the rheological properties of alternate fuel mixtures, such as coal-oil mixtures, coal-water mixtures, and coal-alcohol mixtures. Primary emphasis in this paper is placed on the procedures and techniques used to evaluate alternate slurry fuels in the rheology laboratory at PETC through the spring of 1983. Sophisticated, bench-scale equipment was used to examine viscometric properties and to make settling velocity measurements. Examples of the data developed during this program are given to support the choice of measurement procedures and test conditions. Furthermore, a brief discussion of the applicability of various mathematical models for settling characteristics and rheological properties are included. Areas in

which additional development of techniques is required are discussed. 25 references, 21 figures, 7 tables.

37097 **(EPRI-EA—3610) Time variability of elemental concentrations in power plant ash. Final report.** Holcomb, L.J. (Radian Corp., Austin, TX (USA)). Jul 1984. 172p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920470.

This report describes results of a fly ash sampling and analysis study conducted at a southeastern U.S. power plant. A rigorous sampling and chemical analysis of coal and ash were carried out over a 10-month period to determine the components of sample variability. Coal, coal ash, and extraction procedure extracts of coal ash were chemically analyzed for several inorganic elements. Composite samples were constructed from samples taken on successive three day sets and were used to evaluate the effect of compositing on trace element concentration. Composited coal samples showed increased trace element concentrations in comparison to the means of the individual sample concentrations. Compositing did not affect the trace element concentration of the precipitator ash samples. The components of variance in a sample concentration measurement included time, sampling, and analysis. In most cases the time variability of the sample concentration was comparable to the variability associated with sampling and analysis. A detailed analysis of the time variability of the coal and precipitator ash chemical composition was performed and illustrated through the use of variogram plots. The variograms showed two distinct behavioral trends: (1) negligible time variability compared to the variability of sample collection and analysis, and (2) increasing time variability as lag time increased, through the maximum lag time of 30 days used for calculations. The predominance of the first trend and the disappearance of the other types of variograms found in the previous pilot study are taken to indicate that the variogram is fairly flat at time scales beyond one month. Based on the variability analyses performed in this study, a cost analysis was performed to evaluate the sampling costs and requirements for representative sampling plans designed to measure trace element concentrations. 12 references, 74 figures, 24 tables.

37098 **(FWC/FWDC/TR—84/17) Investigation of pyrite as a contributor to slagging in eastern bituminous coals. Quarterly progress report 9, October 1-December 31, 1983.** Bryers, R.W. (Foster Wheeler Development Corp., Livingston, NJ (USA)). Jun 1984. Contract AC22-81PC40268. 167p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013997.

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The objective of this program is to examine slags formed as a result of firing coals with varying concentration levels, size distribution, and orientation of pyrite with regard to mineral matter in the coal in a laboratory furnace. The program tasks are: (1) selection of eight candidate coals; (2) chemical characterization of the coal samples and identification of the pyrite size, distribution, and orientation with respect to other mineral matter and concentration levels; (3) testing of the candidate coals in a laboratory furnace; (4) chemical and physical characterization of the slag and fly ash samples created by the impurities in the coal sample; (5) influence of coal beneficiation on furnace slagging; and (6) analysis of data and identification of parameters influencing the contribution of pyrite to slagging problems. Washing of the Upper Freeport coal from Indiana County, Pennsylvania, was completed by the last quarter of 1983. The washed product was characterized for mineral content, and a combustion test was performed. Kentucky No. 9 from Henderson County, Kentucky, selected as the sixth coal to be investigated, was characterized using size and gravity fractionation techniques and was combusted in the laboratory furnace to evaluate its slagging and fouling potential. The remaining two coals to be characterized and combusted were identified as Illinois No. 5 and Lower Kittanning from Clarion County, Pennsylvania. 80 figures, 27 tables.

37099 **(PNL—5002) Determination of oil/water and octanol/water distribution coefficients from aqueous solutions from four fossil fuels.** Thomas, B.L. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015229.

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Liquid fossil fuels, both petroleum and synthetically derived oils, are exceedingly complex mixtures of thousands of components. The effect of many of these energy-related components on the environment is largely unknown. Octanol/water distribution coefficients relate both to toxicity and to the bioaccumulation potential of chemical components. Use of these partition data in conjunction with component concentrations in the oils in environmental models provides important information on the fate of fossil fuel components when released to the environment. Octanol/water distribution data are not available for many energy-related organic compounds, and those data that are available have been determined for individual components in simple, one-component octanol/water equilibrium mixtures. In this study, methods for determining many octanol/water distribution coefficients from aqueous extracts of oil products were developed. Sample aqueous mixtures were made by equilibrating liquid fossil fuels with distilled water. This approach has the advantage of detecting interactions between components of interest and other sample components. Compound types studied included phenols, nitrogen bases, hydrocarbons, sulfur heterocyclic compounds, and carboxylic acids. Octanol/water distribution coefficients that were determined in this study ranged from 9.12 for aniline to 67,600 for 1,2-dimethylnaphthalene. Within a compound type, distribution coefficients increased logarithmically with increasing alkyl substitution and molecular weight. Additionally, oil/water distribution data were determined for oil components. These data are useful in predicting maximum environmental concentrations in water columns. 96 references, 26 figures, and 40 tables.

37100 **(SECV-SO—82-52) Methods for the determination of devolatilisation products from brown coal using mass spectroscopy.** Brockway, D.J.; Stacy, W.O. (State Electricity Commission of Victoria, Melbourne (Australia)). 1982. 31p. State Electricity Commission of Victoria, Melbourne, Australia.

Methods were developed for the determination of the devolatilisation products of brown coal using a quadrupole mass spectrometer. Coal samples under an inert atmosphere were heated at rapid rates to a high temperature using an electrically heated stainless steel mesh. The mesh temperature was determined by measuring the increasing resistance across it during the passage of a constant current. A photodiode was also calibrated to measure the mesh temperature. A mass peak programmer was used in conjunction with the mass spectrometer to simultaneously measure the signals due to the species CO, CO/SUB/2 H/SUB/2O C/SUB/2H/SUB/2, CH/SUB/4 and H/SUB/2. Signal intensities were corrected for contributions from other species and used to quantitatively determine the yields of these products.

37101 **Latest research findings from petite sismique trials.** Belesky, R.M.; Bieniawski, Z.T.; Greenfield, R.J. (Pennsylvania State Univ., University Park). *Series on Rock and Soil Mechanics;* 8: 223-238(1984). (CONF-811036—).

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

Research on a novel in-situ technique known as petite sismique is discussed. This geophysical method is capable of estimating the static deformation modules of a rock mass. The petite-sismique technique utilizes a seismic-refraction survey stressing a correlation between shear-wave frequency and the static deformation modulus. Although the technique was introduced in 1967, petite sismique has not been used extensively due to difficulties in shear-wave generation and detection. Recent developments in geophysical instrumentation provided an opportunity to evaluate better the technique in this study. With the objective of assessing the deformation modulus, field trials were conducted in coal and limestone mines. Despite attempts to develop a reliable shear-wave source, difficulties in frequency determinations persisted due to source characteristics and

receiver resonance. A limited number of shear-wave-frequency observations did not confirm the originally documented relationship between shear-wave frequency and the static deformation modulus. The indicated discrepancy is attributed to differences in characteristics of the sources used in the two studies. Arising out of this research are equipment modifications and procedural recommendations which should improve the chances for success in future studies.

37102 **Comparison of hydrocarbon extracts from seven coals by capillary GC and GC/MS.** Farnum, S.A.; Farum, B.; Miller, D.J.; Timpe, R.C. (US Department of Energy Grand Forks Energy Technology Center Box 8213, University Station Grand Forks, North Dakota). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 93-101(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The chloroform extraction of seven coals yielded extracts that gave unique capillary GC profiles. Several groups of hydrocarbon biological markers were detected in the coal extracts by mass spectrometry using selected ion scans. n-Alkanes, pristane, sesquiterpenes, several tricycle alkanes and pentacyclic triterpanes with molecular weights from 398 to 454 were detected. The coal extract profiles fell into four groups: BB1, BB2 (Texas lignites) and MOC (Australian lignite); B3 (North Dakota lignite) and WYO1 (Wyoming, subbituminous); ALB1 (Alberta, Canandian subbituminous), and POW1 (Ohio, bituminous). Profiles were characteristic and reproducible for each coal.

37103 **Geochemical variation of inorganic constituents in a North Dakota lignite.** Karner, F.R.; Benson, S.A.; Roaldsen, R.G.; Schobert, M.M. (US Department of Energy Grand Forks Energy Technology Center Box 8213, University Station Grand Forks, North Dakota). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 123-137(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

This paper summarizes information on the distribution of major and trace elements in a stratigraphic sequence of sedimentary materials in a major lignite producing portion of the Fort Union region of the Northern Great Plains. Previous study of the geochemical variation in these sediments is summarized in the literature (1,2). Major patterns of elemental variations in lignite are related to factors affecting accumulation of both organic and inorganic components during deposition and aqueous precipitation, dissolution, and ion-exchange processes after deposition. Variations in overburden and underclay are dependent upon specific clay mineral variation and relative abundances of quartz- and feldspar-rich silt fractions versus clay mineralrich fractions of the sediment, as well as upon local variation in carbonates and other elements.

37104 **Role of exchangeable cations on the rapid pyrolysis of lignites.** Morgan, M.E.; Jenkins, R.G. (Department of Materials Science and Engineering The Pennsylvania State University, University Park, PA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 138-144(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Recently, research concerned with utilization of the vast reserves of American lignites has expanded greatly. Studies have shown that lignites react quite differently than coals of higher rank when subjected to utilization and conversion schemes. The behavior of lignites is believed to be greatly influenced by the inorganic constituents present. The most significant feature of the inorganic constituents of lignites is the large concentration of exchangeable metal-cations. These cations are mainly alkali and alkaline earth metals associated with the carboxyl groups present in lignites. This research is concerned with the effect of exchangeable cations on rapid pyrolysis of a lignite. It must be concluded that the presence of metal cations in lignites dramatically affects pyrolysis behavior under rapid heating conditions. The presence/absence of metal cations are important in terms of the rate of evolution total weight loss and nature of the pyrolysis products. It is suggested that these data have significant importance in gasification and combustion of lignites.

37105 **Measurement and prediction of low-rank coal slag viscosity.** Streeter, R.C.; Diehl, E.K.; Schobert, M.M. (Bituminous Coal Research, Inc., Monroeville, PA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 174-195(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Since 1980, Bituminous Coal Research, Inc., (BCR) has been conducting measurements on the viscosity of western U.S. low-rank coal slags under a contract with the Grand Forks Energy Technology Center (GFETC), U.S. Department of Energy. This work has been motivated by the realization that very few data exist in the literature on the viscosity of low-rank-coal slags; published correlations relating slag viscosity to coal ash composition were derived from work with bituminous-coal slags, and attempts to apply them to data from low-rank coal slags generally have been unsuccessful; and, from a practical standpoint, data on slag rheology are of considerable interest in support of the operation of a slagging fixed-bed lignite gasifier at GFETC. As a matter of related interest, BCR's slag viscometer was originally put into operation in 1976 to obtain data on the slagging properties of coals intended for use in the BI-GAS coal gasification pilot plant at Homer City, Pennsylvania; the BI-GAS process incorporates an entrained-bed, slagging gasifier. Although the data obtained in these studies have been valuable in interpreting the slagging phenomena observed in the Grand Forks gasifier tests, a more fundamental objective of the current work is to develop correlations that can be used to predict a priori the viscosity behavior of low-rank-coal slags from a knowledge of the ash or slag composition.

37106 **Chemistry and structure of coals: diffuse reflectance IR Fourier transform (DRIFT) spectroscopy of air oxidation.** Smyrl, N.R.; Fuller, E.L. Jr. (Oak Ridge Y-12 Plant, TN). *ACS Symposium Series;* **205**: 133-145(1982). Contract W-7405-ENG-26.

Diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy has been proven to be an excellent means of characterizing coals and related materials. The utility of DRIFT spectroscopy for coal analysis, particularly in relation to monitoring the in situ oxidation of coal is experimentally demonstrated. A comparison is made of its relative merits to those of the KBr pellet and photoacoustic sampling techniques. The rapid response of the Fourier tranform infrared technique is beneficial for kinetic studies related to combustion, liquefaction, gasification, pyrolyses, etc. Experimental equipment and techniques are described for studies over wide ranges of pressure (10^{-5} Pa to ca 1.5 x 10^{2} kPa) and temperature (298°K to 800°K).

0108 Waste Management

REFER ALSO TO CITATION(S) 01080037097, 37142, 37162, 37163, 37199, 37528, 37886

37107 **(DOE/CS/40338—5) North Carolina used motor oil re-refinging program. Plant operation and quality control tests. Topical report 4.** Ferrell, J.K.; Schurter, T.L.; Ritchie, M.; Miller, T.M. (North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering). Jun 1984. Contract FG01-80CS40338. 74p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014456.

A cooperative project is described to re-refine used motor oil for use in state-owned vehicles. The re-refining plant has a rated capacity of two million gallons per year for full operation, utilizes up-to-date technology, and is capable of producing a lube-stock product of very high quality. While the overall project has a number of objectives, the objectives of the work described in this report are to investigate the chemistry of the process and to develop and test a set of quality control analyses that will assure that the plant is producing a satisfactory lubestock product. In addition, a number of tests were also developed to aid in the operation of the plant. This report presents a brief description of the plant and its operation, a discussion of the process and the process chemistry, a

description of the tests developed and used, a discussion of sampling and sample locations, and an evaluation of the tests for assuring satisfactory plant operation and quality control of the lubestock product. 6 references, 4 figures, 15 tables.

37108 **(EPRI-CS—2894-Vol.2) Dry SO_2 particulate removal for coal-fired boilers. Volume 2. 22-MW demonstration using nahcolite, trona, and soda ash. Final report.** Muzio, L.J.; Sonnichsen, T.W. (KVB, Inc., Irvine, CA (USA)). Jun 1984. 98p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920480.

The second phase of a full scale demonstration of the integration of the dry injection of sodium sorbents coupled with a fabric filter baghouse was conducted at Public Service Company of Colorado's Cameo Unit 1, a 22 MW coal-fired utility boiler equipped with an eight compartment baghouse. An initial test series conducted in 1980 had demonstrated the capability of 70% SO_2 removal with nahcolite injection without significant impact on the baghouse operation. The objectives of the second test series were to expand the evaluation of nahcolite to operation at reduced baghouse temperatures, high temperature injection and varied coal applications, and the use of several alternative and potentially more available sorbent materials. SO_2 removal was shown to be primarily a function of the type and rate of sorbent injection. The performance of nahcolite was consistent with the previous tests achieving approximately 80% SO_2 removal with the injection of a stoichiometric amount into the flue gases. Comparable injection quantities of the three trona materials evaluated resulted in 55% SO_2 removal. Soda ash was ineffective in removing SO_2 at all injection rates. No significant differences in the SO_2 removal characteristics of nahcolite were observed while firing coal from several sources. Sorbent injection had no appreciable impact on the baghouse pressure drop characteristics or bag cleanability. Baghouse collection efficiency remained at 99.9+% levels. 3 references, 19 figures, 8 tables.

37109 **(EPRI-CS—3543) Physical, chemical, and biological analysis and evaluation of coal waste blocks in fresh water. Final report.** Woodhead, P.M.J.; Parker, J.H.; Scrudato, R.J.; Gannon, J.E. (State Univ. of New York, Stony Brook (USA). Marine Sciences Research Center; State Univ. of New York, Oswego (USA). Research Center). Jun 1984. 136p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920451.

Portions are illegible in microfiche products.

The objective of this study was to explore the feasibility and potential environmental effects of a method for disposal in lakes of fixated mixes of coal fly ash and FGD scrubber sludge, combustion wastes from power plants. This study is related to an ongoing multidisciplinary investigation of coal combustion wastes in the ocean, the Coal Waste Artificial Reef Program (C-WARP). Waste materials from two coal burning power plants at Conesville, Ohio and Petersburg, Indiana were used to make solid blocks for investigation. A series of laboratory studies measured such physical properties as strength, porosity and permeability. Mineralogy, chemical properties in freshwaters, and characteristics of freshwater leachates under a variety of conditions were determined; the leachates were within regulatory limitations. In laboratory bioassays with sensitive freshwater organisms, the material did not appear to be toxic, except at the very highest concentrations. The laboratory tests were followed by field work in which stabilized blocks were set out in Lake Ontario to observe their interactions with the freshwater environment. During a year in the Lake the blocks maintained their integrity and some slowly increased in strength. Periodic surveys showed that, with time, blocks were colonized by a variety of organisms typical of the Lake. From the first year of studies, the initial results suggest that the blocks may be compatible with the lake environment. 44 references, 27 figures, 28 tables.

37110 **(EPRI-CS—3544) Recovery of metal oxides from fly ash. Volume 1. Executive summary - financial evaluation. Final report.** Wilder, R.F.; Barrett, P.J.; Henslee, L.W. Jr.; Arpi, D. (Kaiser Engineers California, Oakland (USA). Alumina, Chemicals and Synfuels Div.). Jun 1984. 88p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920490.

An engineering, cost and financial evaluation study was carried out for a conceptual commercial plant to process fly ash into marketable metal oxides by the direct HCl acid leach process. The proposed plant site was adjacent to the TVA Kingston, Tennessee power plant and was sized to process 1 million tons of ash (dry basis) per year. The capital cost requirements for the HCl direct acid leach (DAL) optimized process plant were estimated to be $244,390,000. Based upon the reported Kingston plant fly ash analysis and extractability, the conceptual commercial plant would annually produce about 158,000 TPY of alumina, 102,000 TPY of ferric oxide, 46,000 TPY of gypsum, 81,000 TPY of alkali sulfate salts, 866,000 TPY of spent fly ash and 1,940,000 kWh of excess cogeneration power. Potential long term average revenues were projected to be $126,400,000 per year which would indicate a commercial project's economics may be quite adequate. Volume 1 of this study report presents the investment and operating cost data, revenue considerations and an evaluation of profitability. Volume 2 presents the engineering data and capital cost estimates and Volume 3 presents the commercial facility design criteria. 16 references, 16 figures, 20 tables.

37111 **(EPRI-CS—3544-Vol.2) Recovery of metal oxides from fly ash. Volume 2. Engineering data and cost estimates. Final report.** Wilder, R.F.; Barrett, P.J.; Henslee, L.W. Jr. (Kaiser Engineers California, Oakland (USA). Alumina, Chemicals and Synfuels Div.). Jun 1984. 257p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920487.

An engineering, cost and financial evaluation study was carried out for a conceptual commercial plant to process fly ash into marketable metal oxides by the direct HCl acid leach process. The proposed plant site was adjacent to the TVA Kingston, Tennessee power plant and was sized to process 1 million tons of ash (dry basis) per year. The capital cost requirements for the HCl direct acid leach (DAL) optimized process plant were estimated to be $244,390,000. Based upon the reported Kingston plant fly ash analysis and extractability, the conceptual commercial plant would annually produce about 158,000 TPY of alumina, 102,000 TPY of ferric oxide, 46,000 TPY of gypsum, 81,000 TPY of alkali sulfate salts, 866,000 TPY of spent fly ash and 1,940,000 kWh of excess cogeneration power. Potential long term average revenues were projected to be $126,400,000 per year which would indicate a commercial project's economics may be quite adequate. Volume 1 of this study report presents the investment and operating cost data, revenue considerations and an evaluation of profitability. Volume 2 presents the engineering data and capital cost estimates and Volume 3 presents the commercial facility design criteria. 16 references, 3 figures, 2 tables.

37112 **(EPRI-CS—3544-Vol.3) Recovery of metal oxides from fly ash. Volume 3. Commercial facility design criteria. Final report.** Wilder, R.F.; Barrett, P.J.; Henslee, L.W. Jr. (Kaiser Engineers California, Oakland (USA). Alumina, Chemicals and Synfuels Div.). Jun 1984. 156p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920491.

An engineering, cost and financial evaluation study was carried out for a conceptual commercial plant to process fly ash into marketable metal oxides by the direct HCl acid leach process. The proposed plant site was adjacent to the TVA Kingston, Tennessee power plant and was sized to process 1 million tons of ash (dry basis) per year. The capital cost requirements for the HCl direct acid leach (DAL) optimized process plant were estimated to be $244,390,000. Based upon the reported Kingston plant fly ash analysis and extractability, the conceptual commercial plant would annually produce about 158,000 TPY of alumina, 102,000 TPY of ferric oxide, 46,000 TPY of gypsum, 81,000 TPY of alkali sulfate salts, 866,000 TPY of spent fly ash and 1,940,000 kWh of excess cogeneration power. Potential long term average revenues were projected to be $126,400,000 per year which would indicate a commercial project's economics may be quite adequate. Volume 1 of this study report presents the investment and operating cost data, revenue considerations and an evaluation of profitability. Volume 2 presents the engineering data and capital cost estimates and Volume 3 presents the commercial facility design criteria. 16 references, 14 figures, 4 tables.

37113 **(EPRI-CS—3565) Process instrumentation and control in SO_2 scrubbers. Final report.** Delleney, R.D.; Beekley, P.K. (Radian Corp., Austin, TX (USA)). Jun 1984. 159p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920477.

Process control in sulfur dioxide (SO_2) scrubbing systems depends on the use of process instrumentation to provide reliable, accurate measurement of several scrubber system process variables. The objectives of this project are to identify and document the problems and solutions experienced with process instrumentation and control by electric utility SO_2 scrubber users. SO_2 scrubber users and system vendors and process instrumentation vendors were surveyed to identify and document problems and solutions. Survey responses were received from 44 utilities representing 115 electric generating units. Correlation of SO_2 scrubber user experience with process instrumentation was examined relative to a number of variables such as sensor type, placement, and vendor. The results of the survey analysis indicate that pH measurement continues to be a source of significant problems. Proper sensor placement and maintenance reportedly can lessen these problems, however. The other process measurements examined included slurry density, liquid flow, gas flow, gas and liquid pressure, gas differential pressure, and gas and liquid temperature. Current approaches to measurement of these process variables were generally felt to be adequate with the exception of gas flow, which was reportedly unreliable due to sensor plugging and corrosion problems. 4 figures, numerous tables.

37114 **(EPRI-CS—3615) Market survey of fly-ash-derived magnetite.** Kurgan, G.J.; Balestrino, J.M.; Verma, P.S. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Jun 1984. 40p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920482.

This report assesses magnetite use in heavy media separation processes. Magnetite demand estimates are provided for three present and potential market areas - coal cleaning, minerals benficiation, and municipal solid-waste recovery systems. The estimates are given for calendar years 1982, 1985, and 1990. Magnetite demand was evaluated with information obtained from industry contacts, industry projections, and the technical literature. A typical fly ash magnetite extraction process is then designed with estimates provided for capital costs and annual operation and maintenance costs. The designed facility has a capacity of 400,000 tons of fly ash per year; it is similar in capacity and design to the existing Halomet, Inc. plant in southwestern Pennsylvania. Rate of return calculations are performed for various magnetite selling prices and a break-even spot selling price is computed. 20 references, 3 figures, 7 tables.

37115 **(SECV-SO—83-56) Selenium in coal combustion products and derived effluents.** Schaap, H.A. (State Electricity Commission of Victoria, Melbourne (Australia)). 1983. 58p. State Electricity Commission of Victoria, Melbourne, Australia.

Selenium is one of the trace elements which is significantly enriched in the combustion products of Latrobe Valley brown coal. It is highly toxic in excessive concentration and readily soluble in water, and thus it must be considered of potential environmental concern. This report provides extensive data on the solubility of selenium, in ash effluents. Levels were found to increase in almost direct proportion to increases in total dissolved solids and are much higher in Yallourn coal ash effluents than in those from Morwell coal. It was found that the addition of Morwell coal ash to Yallourn ash effluent could significantly reduce selenium levels in the latter. The effects of various factors on selenium levels in ash effluents are described and means of reducing levels are suggested.

37116 **Toxicological and chemical characterization of the process stream materials and gas combustion products of an experimental low-Btu coal gasifier.** Benson, J.M.; Hanson, R.L.; Royer, R.E.; Clark, C.R.; Henderson, R.F. (Inhalation Toxicology Research Inst., Albuquerque, NM). *Environmental Research;* **33**: No. 2, 396-412(Apr 1984). Contract AC04-76EV01013.

The process gas stream of an experimental pressurized McDowell-Wellman stirred-bed low-Btu coal gasifier, and combustion products of the clean gas were characterized as to their mutagenic properties and chemical composition. Samples of aerosol droplets condensed from the gas were obtained at selected positions along the process stream using a condenser train. Mutagenicity was assessed using the Ames Salmonella mammalian microsome mutagenicity assay (TA98, with and without rat liver S9). All materials required metabolic activation to be mutagenic. Droplets condensed from gas had a specific mugtagenicity of 6.7 reverants/μg (50,000 revertants/liter of raw gas). Methylnaphthalene, phenanthrene, chrysene, and nitrogen-containing compounds were positively identified in a highly mutagenic fraction of raw gas condensate. While gas cleanup by the humidifier-tar trap system and Venturi scrubber led to only a small reduction in specific mutagenicity of the cooled process stream material (4.1 revertants/μg), a significant overall reduction in mutagenicity was achieved (to 2200 reverants/liter) due to a substantial reduction in the concentration of material in the gas. By the end of gas cleanup, gas condensates had no detectable mutagenic activity. Condensates of combustion product gas, which contained several polycyclic aromatic compounds, had a specific mutagenicity of 1.1 revertants/μg (4.0 revertants/liter). Results indicate that the process stream material is potentially toxic and that care should be taken to limit exposure of workers to the aerosolized tars emitted in fugitive emissions. Health risks to general population resulting from exposure to gas combustion products are expected to be minimal. 28 references.

37117 **Air emissions from coal conversion.** pp 269-300 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

The primary pollutants associated with coal conversion facilities are particulate matter, sulfur oxides, hydrogen sulfides, and nitrogen oxides. While including some information about these pollutants, this chapter concentrates on the main classes of secondary pollutants: hydrocarbons, sulfur compounds, trace elements, and polynuclear compounds. Emission factors for coal combusion for bituminous, lignite, and anthracite coals are given for particulates, sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide, and aldehydes for various types of utility boilers. Emissions are also listed for 30 trace elements from the stack as well as their distribution in residues for a typical coal, and summary data are given for polycyclic organic matter emissions from various types of boilers. Air pollution from coal gasification and liquefaction plants is also described. The emission source or pollutant and its control method is described for the following: coal storage and transport; coal lockhopper vent gas; pretreater off-gas; depressurization, stripping, and vent gases; sulfur recovery; catalyst regeneration; fugitive emissions; cooling tower plume; and combustion processes. A summary is given of the state of knowledge on the acid rain and global carbon dioxide issues. 43 references, 5 figures, 10 tables.

37118 **Particulate control.** pp 301-336 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Description, design considerations, and calculation of collection efficiencies are discussed for four types of particulate control devices for coal-fired power plants: cyclones, electrostatic precipitators, fabric filters or baghouses, and wet scrubbers. An economic comparison is made for these control devices. New control methods under development are mentioned and liquid solid separations encountered in coal liquefaction processes are briefly discussed. 44 references, 16 figures, 2 tables.

37119 **Flue gas desulfurization.** Rochelle, G.T. pp 337-372 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Throwaway scrubbing processes are the most significant commercially accepted approach to flue gas desulfurization (FGD). It is an aqueous scrubbing in which limestone or lime is reacted with the flue gas to produce $CaSO_3$ or $CaSO_4$, depending upon the oxygen to SO_2 ratio. Slurry scrubbing, clear solution scrubbing, and dry scrubbing (spray drying of solutions into the flue gas) processes and solid waste disposal after these processes are discussed. Two regenerable scrubbing processes (Wellman-Lord process, MgO process) are described. Nine dry processes, partially developed, are summarized. Since the limestone slurry scrubbing is the most im-

portant commercial FGD process, this is described in more detail, noting chemical and physical performance variables, chemical reliability, and mechanical reliability of the system. Economics and status of the technology are also discussed. 106 references, 16 figures, 9 tables.

37120 **Control of nitrogen oxides.** Folsom, B.A.; Heap, M.P.; Pershing, D.W. pp 409-478 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Nitrogen oxides in the exhaust from most combustion sources is about 95% NO and 5% NO_2. The formation mechanisms and effects of fuel and combustion parameters on nitrogen oxides formation are discussed. The main section of the chapter deals with control technologies for large utility boilers. Modifications to the combustion process while still maintaining burner performance is one control method. Load reduction, low excess air combustion, two stage combustion, and flue gas recirculation are discussed. The design and use of low nitrogen oxide burners are described: CE and MHI, Babcock and Wilcox and Babcock-Hitachi, Foster Wheeler and IHI, Kawasaki, US EPA, and Steinmuller. Three low nitrogen oxide combustion systems which reduce emissions by modifications to the combustion process outside of the flame zone are discussed: Babcock and Wilcox primary combustion furnace; Combustion Engineering concentric firing system; and reburning concepts under development by the Japanese. Another control technique is to treat the flue gas. Five processes are considered: selective catalytic reduction; copper oxide system; selective non-catalytic reduction; electron beam system; and wet systems. Nitrogen oxide control costs, technology comparison, and selection of the control technology are summarized. 101 references, 35 figures, 6 tables.

37121 **Liquid and solid waste control for coal conversion processes.** Edgar, T.F.; Humenick, M. pp 479-503 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

The types of water pollutants encountered in coal gasification or liquefaction processes are identified and the operations which can be used for pollutant control are reviewed. The primary pollutants are ammonia, phenols, sulfur compounds, cyanides, alkalinity. Gravity separation, ammonia stripping, solvent extraction, biological oxidation, lime treatment, activated carbon adsorption, cooling tower oxidation, and evaporation ponds are the water treatment operations which are summarized. The integration of these wastewater treatment operations with a Lurgi gasification process and with an Exxon Donor Solvent coal liquefaction process is described. Boiler feedwater treatment, cooling tower operation, and process spill management are discussed in some detail for both processes. Water requirements, treatment costs, and solid waste disposal are briefly discussed. 21 references, 3 figures, 11 tables.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 01090037117, 37137, 37142, 37163, 38387, 38388, 38455, 38458

37122 **(CMRC—82/07-T) Status of investigation and prediction of mining subsidence in the Lethbridge area of Alberta.** Wright, P.L. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Dec 1981. 131p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

This report examines published work on the measurement of subsidence in Illinois, the United Kingdom and Australia in addition to unpublished work in the Lethbridge and Coleman areas of Alberta. A method for the prediction of subsidence, slope and surface strains is discussed together with an analysis of the previous observations in the Lethbridge area. Two specimen cases are examined as illustrations of the methodology used for the prediction of subsidence; the factors used being from observations taken in the United Kingdom. The requirements for subsidence grid and specification of suitable monuments for the monitoring of subsidence in the Lethbridge area are stated. It is emphasized that actual data from observations in the West Canadian Plains conditions must be obtained and correlated with the UK and/or Australia data before accurate predictions of subsidence can be guaranteed.

37123 **Assessment of environmental impacts and public health risks associated with fossil fuel energy technologies.** Ozkaynak, H.; Connor, M.; Ghelardi, R.; Sanford, G.; Smith, M.; Spengler, J.; Thurston, G.; Tony, E. (Harvard Univ., Cambridge, MA). *Alternative Energy Sources;* 490-493(Dec 1983). (CONF-831205—).

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

In recent years plans to develop alternative fossil fuel energy technologies have also generated concern regarding the likely extent of the multi-media environmental and health impacts associated with the operation of these facilities. In an effort to help characterize the nature and the magnitude of these projected impacts, this paper discusses various quantitative approaches that can be used to study the relevant environmental and population health risks. The pollutants considered here include those commonly emitted from fossil fuel energy technologies such as pulverized coal combustion (PCC), coal gasification, fluidized bed combustion (FBC), coal liquefaction and oil shale. In the following, the impacts characterized most will be those resulting from exposures to toxicants emitted into ambient air. However, through an example based upon a generic 5,000 tpd, coal gasification facility, typical environmental and health impacts associated with these new facilities that result from various contaminants released into our air as well as water and solid waste streams will also be analyzed.

37124 **Prediction of extractable metals in retention pond sediments at surface coal mines.** Bogner, J.E. (Energy and Environmental Systems Division Argonne National Laboratory Argonne, Illinois). *Environmental Geology (New York);* 4: No. 3/4, 223-238(1982).

Fifty-two grab samples of bottom sediment in settling ponds were obtained at 17 surface coal mines in the eastern and midwestern U.S. A series of laboratory extraction procedures were designed to simulate a wide range of possible natural conditions. Three types of laboratory extraction procedures were (1) a lowpH buffered extract; a series of low-pH, near-neutral-pH, and high-pH nonbuffered extracts; and a DTPA extract. For the transition metals examined Fe, Mn, Ni, Zn, Co, Cu, Cr, Fe, Al) higher percentages were extracted by the low-pH buffered extract than by the low-pH nonbuffered extract and the DTPA extract. Within the nonbuffered series, higher percentages of individual metals were extracted at lower pH levels. There was generally a consistent order of "extractability" for all the extracts performed. At the mines using a chemical treatment to neutralize acid mine drainage, Mn was the most mobile and Fe and Al the least mobile of the metals considered; at the mines not using a chemical treatment, Ni, Zn, and Co were among the most mobile and Fe, Al, and Cr the least mobile of the metals studied. Two stepwise regression procedures (maximum R^2 improvement and backward elimination) were used to suggest a ranking of independent variables that influence extractable metals. Statistically significant independent variables differed for the various metals. In general, the total amount of metal present was most important in determining metal extractability in the buffered extract at the mines using chemical treatment, and variables related to the natural acidity or alkalinity of the sediment and element interrelationships were important in the other extracts. A detailed examination of regression equations for the buffered extract suggests that it is possible to predict extractable metals using simple regression models based on the total amount of metals present, metals interrelationships, and sediment acidity or alkalinity.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 01100037103, 37136, 37138, 37163

37125 **(DOE/FE/05114—T1) Assessment of the peat resources of Florida, with a detailed survey of the northern everglades.** Griffin, G.M.; Wieland, C.C.; Hood, L.Q.; Goode, R.W. III; Sawyer, R.K.; McNeill, D.F. (Florida State Univ., Tallahassee (USA). Dept. of Geology). 1982. Contract FG18-81FE05114. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84014060.

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Available data, including previous publications, modern soil surveys, and detailed coring in the Northern Everglades for this project have been used to update information on Florida's peat resources. It is now estimated that Florida could, if no other constraints existed, produce 606 million tons of moisture-free fuel-grade peat, which may yield approximately 10.0 x 10^{15} Btu of energy. These estimates are much lower than previously published projections for the state. The principal effort of this survey was in the largest peat region of the state, the Northern Everglades of Palm Beach and adjacent counties, where more than 800 core holes were drilled. Based on analyses of these cores, the Northern Everglades is now estimated to contain 191 million tons of moisture-free peat, with a potential energy yield of 2.98 x 10^{15} Btu. These values are considerably less than previously published estimates, probably due to bacterial oxidation and other forms of drainage-induced subsidence in the Everglades agricultural areas. The present fuel-peat resources of the Northern Everglades occur in 19 separate deposits. Of these, the deposits in the Port Mayaca, Bryant, Six Mile Bend, and Loxahatchee Quadrangles comprise the highest concentration of the resource. These lands are generally privately owned and used for sugar cane and other crops, and the conversion of these lands to peat removal seems unlikely. It seems even less likely that the extensive peat deposits within the Loxahatchee National Wildlife Refuge will be available for fuel use, barring a dire national emergency. The utilization of peat as a fuel must be approached with caution and careful study; large scale use may require state or federal action. 34 references.

37126 **(DOE/R8/01018—T1) Southern Ute Indian tribe: unconventional gas program. Summary of findings.** (Southern Ute Indian Tribal Council, Ignacio, CO (USA)). 1 Oct 1982. Contract FG48-81R801018. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015418.

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The Southern Ute Indian Reservation consists of 700,000 acres of land, located in southwestern Colorado with the southern boundary on the Colorado-New Mexico state line. The two project wells are located near the center of the Reservation. Both wells have 9 5/8" surface casing set below 300 feet. The Oxford # 1 has a 7" production string set at 2802 feet and the Oxford # 2 has 5 1/2" set at 2833 feet. In both instances the production string is set immediately on top of the basal coal bed. The six coal-core samples collected by the Colorado Geological Survey have yielded 4.89, 10.67, 10.68, 11.21, 13.72, and 14.82 cc/g. The five samples of drill-bit cuttings collected by TRW have yielded 0.95, 2.29, 3.65, 6.62, and 10.88 cc/g. As one would expect, the cored intervals from which no coal was recovered appear to be among the best looking intervals on the electric logs. Efforts intended to cause the wells to blow down and unload the water that has accumulated in the hole, have not been successful. The holes will not unload enough water to permit the gas to flow continuously at a commercial rate.

37127 **Coal deposits and properties.** pp 13-37 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

The US has major reserves of all ranks of coal (lignite, subbituminous, bituminous, and anthracite) and the demonstrated reserve base (DRB) is listed for each type of coal by state. This DRB is actually less than 10% of the total resources believed to exist. US reserves and production are compared with those of other countries. The ownership of coal deposits is also noted. Oil companies own 15%; railroads, 7.8%; and coal companies, 5.5% of the reserves; Federal ownership amounts to 61%. Coal properties are then discussed. Coalification and metamorphism, petrography, and chemical structure of coal are briefly discussed. More detail is presented on ultimate and proximate analyses of coal: the properties determined, the ASTM methods used, a listing of ash contents of typical coals, and a listing of the elemental composition of the 4 classes of coal including major, minor, and trace elements. Other physical properties discussed and their methods of determination are: plastic properties, porosity, surface area, density, hardness, and reactivity. 21 references, 3 figures, 9 tables.

0120 Mining

REFER ALSO TO CITATION(S) 01200037044, 37122, 37124, 37163

37128 **(ACIRL-PR—84-3) Gas drainage research for outburst prevention and control: field investigations at Moura No. 4 mine.** Truong, D.; Gray, I. (Australian Coal Industry Research Labs. Ltd., North Ryde). 1984. 87p. Australian Coal Industry Research Labs. Ltd., North Ryde.

A series of investigations were carried out into the gas problem at Moura No.4 underground mine. These investigations involved drilling six drainage holes into the upper and lower C seam to monitor gas flow. Original fluid conditions were assessed by using a grouted in permanent pressure sensor and sorption tests. The results of the investigation have shown a seam of considerable heterogeneity and low permeability. Flow and pressure build up test information concluded that the seam increases in permeability during the drainage. This is thought to be due to coal shrinkage opening up cleating. The recommendations arising from the study are that a pre/post drainage program be implemented in the lower seam.

37129 **(BM-IC—8919) Guidelines for siting product-of-combustion fire sensors in underground mines.** Litton, C.D. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1983. 16p. GPO. Order Number TI84901454.

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This Bureau of Mines report presents a set of guidelines for determining the distribution of product-of-combustion fire sensors in underground mines. Sensor spacing is defined in terms of sensor alarm threshold, ventilation flow rate, and mine entry dimensions. Sensor spacing guidelines are presented for detection of fires from two primary combustibles, coal and wood, which are common to the majority of underground mines. The guidelines are based on data from full-scale and intermediate-scale fire tests conducted by the Bureau of Mines.

37130 **(BM-RI—8521) Fire resistance test method for conveyor belts.** Sapko, M.J.; Mura, K.E.; Furno, A.L.; Kuchta, J.M. (Department of the Interior, Washington, DC (USA)). 1981. 32p. GPO*. Order Number TI84901448.

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A moderately scaled apparatus was developed by the Bureau of Mines to determine the fire resistance characteristics of mine conveyor belts and similar type materials. The design of the apparatus was based upon data obtained in full-scale fire tests and features a radiant panel to preheat the belt and a methane-oxygen ribbon burner to ignite the sample under ventilating conditions in a rectangular duct. The test method overcomes the limitations of existing laboratory-scale methods and provides a measure of both ignitability and flammability in quantitative terms. Flame propagation depended upon such variables as air velocity, ignitor heat flux, and belt width and height in the test chamber. Data are presented for nine belt materials and fire resistance ratings are proposed in terms of the flame spread rate, heat release rate, and the critical ignitor heat flux. The ratings discriminate between the fire hazard posed by different fire-resistant belts and tend to be in reasonable agreement with those obtained in full-scale fire tests. 19 references, 8 figures, 9 tables.

37131 **(CMRC—79/3-T) Evaluation of some constraints affecting development entries.** Wright, P.L. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Feb 1979. 89p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

This study is concerned primarily with the plains type coal field where vast reserves of sub-bituminous coal lie at comparatively shallow depths (50 to 250 m), are gently dipping, but with varying roof and floor conditions. The report concentrates on roof support and mechanized coal removal, with design being an inherent part of the study of factors of constraints.

37132 **(CMRC—79/5) Longwall face: optimum length.** Wright, P.L.; Reid, H.W. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1979. 55p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

A program was developed to permit the rapid evaluation of a potential longwall mining project, the optimization of face dimensions to achieve minimum costs, and examination of the sensitivity of costs to ranges of mining and geologic parameters. The program also allows the rapid re-evaluation of a project at a later date when, for instance, capital costs have escalated significantly or improved equipment has become available. The examples illustrated determine only estimated district costs per raw tonne for a model mine.

37133 **(CMRC—80/04-T) Computer modelling of entry drivage.** Reid, H. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1980. 33p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

A computer program, DEVELOPMENT, was written to model equipment entry drivage in underground coal mines. The program is a deterministic quantitative model based on the interdependence of continuous miner cutting, coal clearance, and entry support times. Unlike other underground mining computer programs, DEVELOPMENT requires little data preparation and input time. This program can be used to analyze the effects of changes in mine design, equipment, or operating method for an established or proposed mine. The program can also be used to determine the sensitivity of the ultimate system performance to design parameters. The total shift advance calculated by this program may be used as input to CMRC's longwall optimum face program.

37134 **(CMRC—81/26-T) Diagnostic maintenance.** Wright, P.L.; Reid, H. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Jun 1981. 35p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

This report gives the results of work carried out to identify the uses of infrared thermometers and vibration analyzers as instruments for diagnostic maintenance of mining equipment. (Tasks 79/10 and 80/06). Infrared equipment has limited usefulness for this work and does not warrant introduction as a regular maintenance tool. Its use for the monitoring of electrical junction boxes and cables may be justified. Vibration measuring equipment is more sensitive and could have beneficial results on suspect equipment.

37135 **(CMRC—81/40-T) Some experience of production extraction related to the direction of the seam inclination.** Wright, P.L. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Jul 1981. 18p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

This report records the relative success of de-pillaring in the Smoky River Coalfield in the period 1970 to 1978. Particular attention is paid to the orientation of the direction of de-pillaring and the inclination of the seam.

37136 **(CMRC—82/17-T) Evaluation of underground coal mining parameters of former western Canadian coal mines for future mining reference.** Grant, F. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1982. 110p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

The present energy shortage has indicated that coal will be a major source of fuel for power and heat during the next century. The coal resources of western Canada are large and, if mined and used efficiently, should help to make the area energy rich. The physical characteristics of these coal resources vary widely from east to west in quality, from lignite and sub-bituminous to semi-anthracite; in geologic setting from flat seams under shallow depths of cover on the eastern plains to deep pitching seams disturbed by mountain building tectonics. The Alberta Mines Branch have indexed the Alberta coal mines by number amounting to over 1700 and British Columbia Mines Branch also lists a large number of mines. Only a few mining companies have operated from the turn of the century to the present times and these with major changes. Most of the companies worked for short periods of time and then stopped. They mined coal from a variety of geological conditions, met with success or failure in solving their mining problems and closed for numerous reasons. The experiences of the former mines in dealing with their troubles should be of value to future operations despite more modern mining methods.

37137 **(CMRC—82/19-T) Selective materials handling for strip mine reclamation in the Ardley coal zone.** Chopiuk, R.G.; Chekerda, K.J. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1982. 142p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

One of the major tasks facing the coal mining industry today is in dealing with environmental concerns. The requirements of selectively handling topsoil and sub-soil for reclaiming plains strip mines are causing significant expenditures in overall mining costs. This report was developed to provide a reference for industry and government that outlines the technical feasibility and the comparative costs for five major methods of selective materials handling. Specific systems covered include dragline/dozer, scraper/dozer, shovel/truck, bucket wheel excavator, cross-pit conveyor, and round-pit conveyor. Evaluations are based on the removal and placement of incremental layers from 0 to 3 metres, segregating the topsoil and subsoil horizons.

37138 **(CMRC—83/41-T) Compilation of Canadian research projects in coal exploration, mining and preparation 1983.** Chekerda, K.J.; Germain, R.J. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Jul 1983. 30p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

A compilation of research projects in the areas of coal exploration, mining and preparation. Mining is subdivided into three areas: surface, underground and ground control. Preparation is also subdivided into several categories. Geological projects include application or method oriented projects that deal with problems in exploring and evaluating coal properties. Such methods include drilling, coring and geophysical logging techniques as well as computer applications. Some structural geology projects are also listed. Mined land reclamation projects are not fully covered. Projects involving materials handling are included, but those involving soils research and revegetation efforts, for the most part, are omitted. Long distance coal transportation research is not included except for those projects that have some direct application to mine site transport of coal or where mine site activities might have a later effect on the transportability of coal.

37139 **(DOE/FE/00016—T42) Research on air sprays and unique foam application methods. Thirty third monthly report, May 1-31, 1984.** (Engineers International, Inc., Westmont, IL (USA)). 19 Jul 1984. Contract AI01-81FE00016. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014674.

The construction of the longwall mockup gallery has been completed. Testing has been completed and the data analyzed for the air sprays system. A maximum of 75% air spray effectiveness was obtained from the data analysis. Laboratory tests on pick face foaming and flushing foam through scroll sprays were successfully completed. The first underground testing of the foam system through the scroll sprays as well as external sprays located on the lead ranging arm was conducted. Data analysis revealed a 58% reduction in dust concentration at the operator's position for the 40 gpm foam system as compared to the existing 80 gpm water spray system. Dust samples analyzed by Consol personnel provided a greater than 60% reduction of dust concentration at the operator's position. The second field test of the foam system was very successful and the mining company was considering using the system on a long-term basis. However, the operating cost of the system was higher than the cost the mining company was willing to afford, and consequently further operation of the foam system was suspended.

37140 **(DOE/FE/00016—T52) Technical progress report No. 35, June 1-30, 1984.** (Foster-Miller, Inc., Waltham, MA (USA)). 25 Jul 1984. Contract AI01-81FE00016. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014911.

The two-week stageloader evaluation at Emery's Wilberg Mine has been successfully completed. The evaluation employed a multichannel data logger to monitor five RAM-1 samplers strategically located in the headgate region. An additional RAM-1 was employed to gather floater data. Samplers were located at the intake, belt entry, headgate operator, stageloader, and No. 20 shield; the frequency of sampling was once every 10 seconds. The mining operation produced very consistent pass-by-pass timed cutting cycles.

Once the shearer began either a cutting or clean-up pass, the machine invariably finished the pass without any stoppage. The consistency of the operation leads FMI to believe that the data should be reliable and the results meaningful. Testing was conducted with the stageloader both covered and uncovered. Each of the above conditions was evaluated under various permutations of the four spraybars and a series of flow rates. The objective was to determine the effectiveness of the various spraybars and also the magnitude of the improvement under various water flow rates. The dust concentrations were recorded by the data logger onto tape. The tape requires a computer program to convert and manipulate the data. FMI's existing computer programs required some modification to handle the data. These program modifications are now completed and the data will be printed and analyzed during the next reporting period.

37141 **(N—8328971) Linear discrete smoothing of multipass processes.** Edwards, J.B.; Yazdi, A.M.S.R. (Sheffield Univ. (UK)). May 1982. 25p. (RR—191). NTIS, PC A02/MF A01.

The effect of an interpass process on the multipass behavior of an idealized coal-cutter steering process is analytically examined. A simple delay equation is used and the resulting analytical predictions are confirmed by simulation and used to guide the choice of parameters in the full process simulation. It is found that by enlarging conveyor tray lengths it is possible to stabilize the true process. More elaborate models were also examined, concluding that multipass stability can be produced by spatially discrete smoothing.

37142 **Coal extraction.** pp 38-55 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

As of 1980, about 60% of the total coal mined in the US was surface-mined. The advantages of surface mining over shaft mining are listed. The four basic techniques used in surface mining are discussed. These are contour mining, area mining, open pit mining, and auger mining. When coal seams are at a depth greater than 300 feet, underground mining is used. Four different techniques of underground mining are described. These are conventional room-and-pillar mining, continuous room-and-pillar mining, longwall mining, and shortwall mining. Representative capital and operating costs and energy requirements are compared for surface and underground mining. Environmental impacts are also compared: air pollution, particulate emissions, gaseous emissions, water pollution, and solid wastes. The available environmental controls and their economics are briefly discussed. 21 references, 5 figures, 5 tables.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 01300037039, 37040, 37073, 37095, 37096, 37098, 37114, 37138, 37163

37143 **(CMRC—78/4) More accurate determination of coal stockpile inventories.** Wright, P.L.; Hernadi, N. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Aug 1978. 9p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

The coal density within a 12 m high stockpile can range from 836 kg/m/SUP/3 to 948 kg/m/SUP/3. Thus the use of a constant density to calculate the stockpile inventory could lead to a variation on a nominal 100,000 tonne stockpile of 12,500 tonnes. At present day metallurgical coal prices, this represents a range in inventory value of over 600,000 dollars. A more accurate evaluation of the stockpile inventory can easily be achieved by the simple expedient of including the density variations in the calculations. Laboratory compression tests at different moisture contents have been used to simulate the coal compaction, and to derive practical densities for coal at various heights within the stockpile. The resulting graphs of density variation with stockpile height at different moisture contents can be combined with accurate cross sections to volumetric surveys to produce on accurate quantification of the stockpile for inventory purposes.

37144 **(CMRC—81/21-T) Review of dry cleaning processes.** (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1981. 59p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

Dry cleaning processes to clean coal attained their maximum level of importance in the late 1950's and early 1960's, but have suffered a rapid decline since then. This decline can be attributed to a deterioration in quality of run-of-mine coal and the introduction of more efficient wet processes. However, problems and high costs associated with fine refuse dewatering have sparked a new interest in these processes, particularly in Alberta where fine montmorillonite clays can cause severe washing and dewatering problems. The report reviews both gravity dependent and non-gravity dependent processes. Special emphasis is given to the former since they have greater immediate commercial significance.

37145 **(CMRC—81/50-T) Program and facilities for coal preparation research.** Butcher, S.G. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Aug 1981. 43p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

The state-of-the-art for coal preparation in western Canada is reviewed. Future market requirements and the types of coals likely to be mined in Alberta were identified with particular attention to their variable beneficiation characteristics. A survey of research programs and facilities was conducted. Current programs in Canada and USA concentrate on the higher rank eastern coals. On a worldwide basis, very little attention has been given to beneficiation by moisture removal and virtually no work has been done on dry cleaning. These processes need further development if lower rank western Canadian coals are to be upgraded to the heating values needed for export markets.

37146 **(CMRC—81/53-T) Spontaneous combustion: part 1 - literature review.** Rashid, M.A.; McIntyre, C.D. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Jul 1982. 48p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

Review of spontaneous combustion includes the reaction mechanism, influencing factors, methods of storing coal, prevention and detection. Spontaneous combustion is mainly caused by oxidation of carbonaceous matter at ambient temperatures. In the absence of oxygen or air, reactions which support spontaneous combustion will not proceed. The oxygen taking part in the reaction is chemisorbed at active sites on the surface of coal particles. The available reaction sites progressively increase with the reduction in coal rank. Readsorption of moisture, available oxygen concentration or airflow, quantity of coal fines, and particularly temperature of coal all play a significant role in the rate of spontaneous heating. Coal is most liable to spontaneous combustion if it is stored in a conical pile. Thus the procedure of placing the coal in layers and compacting each layer to eliminate oxygen penetration has been suggested. Other methods of storage and capping with impervious substances are reviewed. Anti-pyrogens such as calcium bicarbonate, petroleum products and their emulsions have been tried in the past. Heating zones in a coal stockpile are generally located by inserting a pipe (probe) and then simply measuring the local temperature. More recently combustion products such as CO and CO/SUB/2 have been monitored to estimate the conditions in inaccessible zones.

37147 **(CMRC—82/05-T) Dry cleaning of coal in counter-current fluidized cascade.** Germain, R.J.; Butcher, S.G.; Beeckmans, J.M. . (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Apr 1982. 20p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

The counter-current fluidized cascade is a pneumatic gravity separation device currently being developed for dry cleaning of coal. It utilizes a fluidizing medium limestone or sand mixed with hematite or magnetite to clean coal coarser than about 0.6 mm. Coal in the size range 0.6 x 0.1 mm is cleaned without added medium. The cascade has achieved separations of similar accuracy to those obtainable with a Baum Jig. Coal throughput rates of up to 11 t/h per meter width having been achieved. A pilot plant is being constructed to test the cascade at up to three times this rate.

37148 **(CMRC—83/15-T) Analysis of overland conveyors for coal transport.** Chopiuk, R.G.; Chekerda, K.J. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1983. 109p. Coal Mining Research Centre, Edmonton, Alberta, Canada.

The use of long, overland conveyor systems for transporting coal is relatively common in Europe. Conveyors have proven to be one of the most cost efficient methods of handling large volumes of material, including coal, over long distances. In Canada and the United States, however, this technology is still fairly new. Conveyor use has been limited to processing plant areas primarily, although a small number of operations are just now beginning to operate or plan overland systems. In response to a need by industry for consolidated information on these systems, a literature survey was conducted and a list of over 40 references compiled. A comparison of conveyor types (conventional troughed-idler and cable supported belt) is made with respect to constuction, cost, service ability and application. Details of the economics of installation, ownership and operation of conveyor systems are examined. Case studies of operating systems are provided. Comparisons between truck haul, conventional and cable-supported conveyors are done for transporting run-of-mine coal at two hypothetical operations, one at a foothills location, and the other in a plains environment. The analysis shows the economic and technical feasibility of using overland conveyors as the most effective means of transport for the conditions outlined.

37149 **(CONF-840107—Absts.) Advanced coal cleaning: impact of coal quality on downstream processes. Final technical report.** (Engineering Foundation, New York (USA)). 1984. Contract FG22-84PC72010. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014183.

From 4. advanced coal cleaning conference; Santa Barbara, CA, USA (8 Jan 1984).

The basic objective of the conference was to start a dialog between the coal producers and the coal users on the question of the impact of coal quality on the costs of producing electricity. The advantages of using coal for this purpose are obvious and significant. The point of view of the coal producers was that coal can be cleaned to fairly high quality levels with existing technology. The coal industry is ready to meet any reasonable demands made on it by the utilities. The utility perspective treats coal quality as a single variable - albeit an important one - in the economic relationship of power production. Thus, the utilities will do whatever gives the lowest cost on a per-Kwh basis within the other constraints imposed upon them. The general consensus of the conference, if there was one, was that the consistency of fuel quality is important. The question of absolute quality levels was not tackled. This volume contains 27 abstracts of the papers presented at the conference. All abstracts have been processed for inclusion in the Energy Data Base.

37150 **(EPRI-CS—3548) Mechanism of fine-coal dewatering by silicone additives. Final report.** Owen, M.J. (Dow Corning Corp., Auburn, MI (USA)). Jun 1984. 97p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920436.

The objectives of this study were to explore the utility of silicones in the enhancement of coal dewatering and in particular to elucidate the mechanism of the effect. Both basic surface studies and practical dewatering assessments were used to address the problem. Several techniques were employed including surface tension, contact angle, and zeta potential measurements, ESCA (Electron Spectroscopy for Chemical Analysis), flow microcalorimetry and the EIMCO leaf filter laboratory dewatering test. A wide variety of silicone materials and bituminous coals were examined and comparisons were made with the behavior of organic flocculants and surfactants. Three mechanisms are commonly encountered in dewatering discussions: surface tension lowering; contact angle increase; and flocculation effects. All three elements were found to be important in coal dewatering by silicones. The most effective and widely applicable silicones were found to be aminofunctional polymer emulsions. It is postulated that these function by a combined hydrophobing/flocculation effect. Highly surface active silicone surfactants were also found to be useful when used in combination with organic flocculants. Silicone materials were identified that were more effective than organic flocculants and surfactants on two of the three key coals examined in this study. The project culminated in a successful plant trial of the aminofunctional silicone emulsions at the Bradford Coal Co., Bigler, PA. 31 references, 31 figures, 21 tables.

37151 **Coal transportation.** pp 56-76 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Alternative transport technologies, trends in coal transportation, and the potential environmental impacts from each transportation mode are discussed. Transport systems include railway trains, slurry pipelines, barges on inland waterways, highway truck movement, overland conveyor belts, and long distance electrical transmission. Transportation costs, coal storage and handling, and energy consumption required by the different transport modes are also discussed. 16 references, 6 figures, 5 tables.

37152 **Coal preparation and cleaning.** pp 77-112 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Major unit operations performed during coal preparation include size reduction, screening, dewatering and drying, briquetting, cleaning by wet and dry processes, and water pollution abatement. The operations and the equipment used are discussed. Size reduction can be done with crushers (rotary breaker, roll crushers, hammer mill, impactors), with grinders (tumbling mills, roller mills), or with direct-firing coal pulverizers. The pulverizing properties of coal are briefly discussed. Screens which are described are gravity bar, vibrating, shaker, revolving, and cross-flow screens. The variability of mineral matter in coals and the sulfur content are discussed. Physical beneficiation methods and equipment include: jigs, fine-coal jigs, dense medium, concentrating tables, hydrocyclones, dense-medium cyclones, pneumatic separators, and froth flotation. Nine physical processes and seven chemical processes for coal beneficiation currently under development are summarized. 27 references, 15 figures, 9 tables.

0140 Combustion

REFER ALSO TO CITATION(S) 01400037098, 37146, 37199

37153 **(CONF-8405124—1) Control of alkali vapors by a granular-bed sorber.** Lee, S.H.D.; Henry, R.F.; Myles, K.M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014739.

From 4. annual contractors' meeting on contaminants in hot coal-derived gas streams; Morgantown, WV, USA (15 May 1984).

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This work supports the program to develop granular sorbents for the control of alkali vapors from pressurized fluidized-bed combustion (PFBC). A laboratory-scale pressurized test unit was used to characterize two potential sorbents identified earlier, activated bauxite and Emathlite. Experimental tests have been conducted to measure the rate of alkali (Na + K) evolution from the sorbent material itself in a gas stream with temperature (850°C), pressure (10 atm absolute), and composition closely simulating actual PFBC flue gas. The rate was then used to evaluate the significance of the alkali evolution for its possible effect on the turbine by comparing with the currently accepted alkali tolerance of an industrial gas turbine. A laboratory-scale demonstration of use of a granular-bed sorber for the control of alkali vapors from PFBC has been initiated. Details of a high temperature/high pressure sorber system designed for this demonstration are discussed. 12 references, 5 figures, 2 tables.

37154 **(DOE/FE/60014—T1) Assessment of research needs for coal utilization. Appendix B. Site visit reports.** (California Univ., San Diego, La Jolla (USA)). May 1983. Contract FG03-82FE60014. 471p. NTIS, PC A20/MF A01; 1; GPO Dep. Order Number DE84012819.

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The DOE Coal Combustion and Applications Working Group made site visits to research organizations for the assessment

of research needs for coal utilization. Appendix B contains edited copies of site-visit and other reports prepared by CCAWG members. Some of the hand-out materials prepared by DOE contractors and others are included (without explication) to permit readers the construction of a coherent picture of work in progress. Twenty-six papers have been entered individually into EDB and ERA. (LTN)

37155 **(DOE/MC/14061—1498) Investigation of formation of nitrogen compounds in coal combustion. Final report.** Blair, D.W.; Crane, I.D.; Wendt, J.O.L. (Exxon Research and Engineering Co., Linden, NJ (USA); Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). 1 Oct 1983. Contract AC21-80MC14061. 264p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84000222.

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This is the final report on DOE contract number DE-AC21-80MC14061. It concerns the formation of nitrogen oxide from fuel-bound nitrogen during coal combustion. The work reported was divided into three tasks. They addressed problems of time-resolving pyrolysis rates of coal under simulated combustion conditions, the combustion of the tar that results from such pyrolysis, and theoretical modeling of the pyrolysis process. In all of these tasks, special attention was devoted to the fate of coal nitrogen. The first two tasks were performed by Exxon Research and Engineering Company. 49 references.

37156 **(DOE/PC/60809—T2) Alkali atom impact reactions on coal combustion substrates. Quarterly report No. 3, March 15, 1984-June 15, 1984.** Bennett, J.E. (Arizona State Univ., Tempe (USA). Dept. of Chemistry). Jul 1984. Contract FG22-83PC60809. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014812.

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Quarterly Reports Nos. 1 and 2 included results from six tube furnace experiments, two of which involved K_2SO_4-graphite reactions, and four of which were with Na_2SO_4-graphite mixtures. Results from simultaneous quadrupole mass spectrometric-microgravimetric analyses of vapor from K_2SO_4-graphite reactions were also reported, with preliminary results for similar experiments involving Na_2SO_4-graphite reactions in the range 725 to 950°C. It was pointed out that in the latter work, no $Na^+(g)$ had been observed, nor had any Na-bearing species been identified among the vapors from the reaction of Na_2SO_4 with graphite. In this communication (Quarterly Report No. 3) we discuss the x-ray powder diffraction (XPD) and characteristic x-ray fluorescence results from new tube furnace experiments, one configuration involving mixtures of Na_2SO_4 to K_2SO_4-graphite and in the other mixtures of K_2CO_3-graphite (both with iron (III) sulfate films as targets for the impacting alkali atoms). Simultaneous quadrupole mass spectrometric-microgravimetric experiments have been extended to 1200°C for Na_2SO_4-graphite mixtures. Rates-of-effusion data are reported for the first time for the Na_2SO_4-graphite reaction, and some clarification is provided regarding the behavior of Na(g) in these reactions. 2 figures, 3 tables.

37157 **(SECV-GO—82-53) Aeodynamics of burner jets designed for brown coal fired boilers: literature survey.** Perry, J.H. (State Electricity Commission of Victoria, Melbourne (Australia)). 1982. 39p. State Electricity Commission of Victoria, Melbourne, Australia.

The adequate assessment of pulverised brown coal fired boilers requires prediction of ignition and combustion characteristics of the burner jets. To establish the present level of understanding of jet development from multiple slot burners typical of tangentially fired boilers, an extensive survey of literature in the field of free jet flows has been undertaken. The survey has covered experimental and theoretical advances in relation to round jets, two phase flow in round jets, co-axial round jets, two dimensional jets, and three dimensional jets, with the final two types considered as single jets, in pairs or in a row. It was found that very little information was available of direct relevance to slot burners. Flow development in the near field of the jet is influenced by a number of geometric, fuel particle and fluid flow parameters. It is concluded that an extensive experimental investigation is warranted, with the concurrent development of a mathematical model.

37158 **(SECV-GO—82-54) Victorian brown coal ash: past, present and future problems.** Ottrey, A.L.; Johnson, T.R. (State Electricity Commission of Victoria, Melbourne (Australia)). 1982. 19p. State Electricity Commission of Victoria, Melbourne, Australia.

This report describes the properties of Latrobe Valley brown coals and their behaviour in pulverized fuel fired boilers. Operational experience is based on utilization of brown coal from open cuts at Yallourn and Morwell in power stations ranging in size from 200 to 375 MW. Problems encountered include furnace wall fouling, convection pass fouling and particulate removal from flue gases. Design features and operational parameters necessary to overcome these problems are discussed. Similar problems (to an ever greater extent) are possible in the development of new areas. Preliminary coal property data on four of these new areas are presented.

37159 **(SECV-GO—83-58) Facilities for coal combustion testing in the State Electricity Commission of Victoria.** (State Electricity Commission of Victoria, Melbourne (Australia)). 1983. 24p. State Electricity Commission of Victoria, Melbourne, Australia.

This report describes the main facilities available in the State Electricity Commission of Victoria for pilot scale investigations of coal combustion and ash fouling, and outlines the tests that would be conducted on a coal presented for investigation.

37160 **(SECV-SO—83-64) The effect of combustion conditions on the formation of NO/SUB/x in brown coal flames.** Byrne, C.J. (State Electricity Commission of Victoria, Melbourne (Australia)). 1983. 28p. State Electricity Commission of Victoria, Melbourne, Australia.

This report presents results obtained in an investigation into the effect of combustion conditions on the formation of NO/SUB/x in brown coal flames. The work was carried out in a 35 kg/h experimental furnace using a swirl burner. NO/SUB/x production was found to be sensitive to secondary air swirl with minimum NO/SUB/x occurring at medium swirl (S equals 0.5-0.7). Decreasing the following parameters decreased NO/SUB/x: excess air; secondary air temperature and load. Fuel fineness and the moisture content of the fuel stream had no effect on NO/SUB/2. The effectiveness of staged combustion as a technique for controlling NO/SUB/2 emissions from brown coal flames was also studied.

37161 **Pyrolysis of organic compounds. 1. Flash vacuum pyrolysis (FVP) of coal-model organo sulfides and their S-oxides.** Davis, F.A.; Panunto, T.W.; Awad, S.B.; Billmers, R.L.; Squires, T.G. (Drexel Univ., Philadelphia, PA). *Journal of Organic Chemistry;* **49**: No. 7, 1228-1230(6 Apr 1984). Contract W-7405-ENG-82.

The primary pyrolysis reaction of sulfides, sulfoxides, and sulfones (1-3), in the gas phase at 500-900 °C, is homolytic cleavage of the C-SO/sub n/ bond. The order of reactivity, sulfoxide >> sulfone > sulfide, is consistent with the relative stabilities of the radicals produced. At 900°C a novel and synthetically useful rearrangement of dibenzothiophene 5-oxide to 1-hydroxydibenzothiophene was observed. 21 references, 1 table.

37162 **Polycyclic aromatic compounds in fluidized bed combustion of coal.** Walsh, P.M.; Beer, J.M.; Biermann, K.; Chiu, K.S. (Massachusetts Institute of Technology Cambridge, Massachusetts 02139). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 251-264(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Polycyclic aromatic compounds (PAC) have been determined in the gas and particulate effluents from fluidized bed combustion of coal, lignite, and oil shale by a number of investigators. A bibliography of the reports of these investigations is contained in a paper by Chiu, Walsh, Beer, and Biemann (1983). The concentrations of PAC in the effluents are often quite low, but depend upon the combustor configuration and operating conditions. The goal of the present investigation is to develop a mechanism consistent with measured rates of formation and destruction of PAC in atmospheric

pressure fluidized bed combustion (AFBC), so that a rational approach may be taken to adjustment of conditions for minimization of PAC in the effluents. PAC are determined in samples taken from the freeboard (space above the bed), rather than from the exhaust, to observe the evolution of the PAC distribution within the combustor. Mass fractions of the most abundant PAC observed in the freeboard during AFBC of high volatile bituminous coal were reported by Chiu, et al (1983). Some correlation of the rates of disappearance of PAC with particle concentration was noted by Dutta, Chiu, Walsh, Beer, and Biemann (1983). In the present paper theoretical estimates of the rates at which PAC might be consumed by heterogeneous reactions are compared with experimental rates estimated from PAC profiles determined by Chiu et al (1983).

37163 **Coal processing and pollution control.** Edgar, T.F. Houston, TX; Gulf Publishing Company (1983). 579p.

This book discusses the principles behind coal technology rather than just detailing processes and equipment. Chapters are presented on the supply and demand outlook; coal deposits of the US and their coal properties; coal mining techniques, costs, and environmental controls; coal transportation systems; coal preparation and cleaning; pyrolysis processes; gasification; liquefaction; combustion; air emissions; particulate control; flue gas desulfurization; acid gas control; control of nitrogen oxides; and liquid and solid waste control for coal conversion plants. A glossary of about 700 words, an appendix summarizing analytical techniques for coal analysis, and an appendix which describes Federal legislation affecting coal utilization are included. 625 references, 165 figures, 107 tables.

37164 **Coal combustion.** pp 221-268 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

Coal combustion technology primarily for electric power generation is discussed. Fixed bed coal firing, design considerations for stoker systems, entrained coal firing, design features of pulverized coal boilers, effects of coal ash, sodium, and calcium, the slagging and fouling of heat transfer surfaces, and corrosion are described for conventional combustion technology. Operation and design considerations for boilers and the process of fluidized coal combustion are discussed. Economics of fluidized-bed combustion and pulverized coal combustion are compared. Coal gasification with combined-cycle power generation is discussed, including technical factors influencing the design of a low Btu gasification/combined-cycle facility (LBG/CC), commercial development, economics, potential pollutants, and future applications of LBG/CC. Magnetohydrodynamics is also briefly described. 46 references, 17 figures, 9 tables.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 01500037142, 37151, 37163, 37186, 37415

37165 **(DOE/EIA—0363(84)) Annual prospects for world coal trade 1984: with projections to 1995.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jul 1984. 45p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. Order Number DE84014371.

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Projections for U.S. and world coal trade and factors affecting the growth of world demand for metallurgical and steam coal are examined. The report also discusses the history of world coal trade; the basic elements and physical components of coal supply, transportation, and demand; and the structural and behavioral relationships governing coal supply and demand. 3 figures, 14 tables.

37166 **Coal in the national energy picture.** pp 1-12 of Coal processing and pollution control. Edgar, T.F. Houston, TX; Gulf Publishing Company (1983).

The annual energy consumption of coal, wood, petroleum, natural gas, hydropower, and nuclear power in the US from 1850 to the present is shown in a graph, and the 1980 energy consumption of these fuels are listed according to usage (residential and commercial, industrial, transportation, electrical power generation). The future energy demand is discussed briefly. The last half of the chapter deals with coal, the US supply and demand, environmental impacts, synthetic fuels production outlook, and processing and pollution control. 9 references, 3 figures, 2 tables.

0160 Health And Safety

REFER ALSO TO CITATION(S) 01600037116, 37802, 38598

37167 **(PB—84-166636) Recommended guidelines for oxygen self-rescuers. Volume 4. Underground non-coal mining. Open file report Dec 80-Dec 82.** Berry, D.R.; Mitchell, D.W. (Foster-Miller, Inc., Waltham, MA (USA)). Jun 1983. 176p. NTIS, PC A09/MF A01.

Supplement to PB81-225872 and PB81-225880.

The Bureau of Mines initiated a contract for the development of guidelines for the storage and use of self-contained self-rescuers (SCSR) in underground noncoal mines. An SCSR is a device capable of supplying, in an emergency, 1 hour of self-contained oxygen (no breathing of mine air). The information and recommendations in this report were developed primarily from three sources: discussions with mine representatives (including management, labor, and government), site visits in underground mines, and a detailed analysis of every reported noncoal accident that produced hazardous atmosphere during the 5-year period 1976-80, plus 10 other major incidents from prior years.

37168 **(PB—84-168764) Laboratory feasibility studies for the fluidized-bed combustion of spent potlining from aluminum reduction. Final report.** Kim, B.C.; Mezey, E.J.; Hopper, D.R.; Wensky, A.; Heffelfinger, R. (Battelle Columbus Labs., OH (USA)). Mar 1984. 60p. NTIS, PC A04/MF A01.

The report gives results of a preliminary assessment of the technical feasibility and environmental acceptability of a fluidized-bed combustion (FBC) process for the disposal of spent potlining waste from the aluminum reduction process. Technical efforts included: (1) differential thermal analyses (DTAs) to establish the operating temperature range to prevent agglomeration in a FBC process, and (2) fixed-bed combustion experiments to determine cyanide destruction and gaseous emissions expected from a FBC process. The gaseous emissions, however, can be adequately controlled and should not pose an insurmountable technical barrier in the FBC process.

37169 **(PB—84-170182) Carcinogen assessment of coke oven emissions. Final report.** (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Feb 1984. 221p. (EPA—600/6-82-003F). NTIS, PC A10/MF A01.

See also PB83-129551.

Coke oven workers in Allegheny County, Pennsylvania and at 10 non-Allegheny County coke plants in the United States and Canada were found to be at an excess risk of mortality from cancer of all sites and from cancer of the lungs, bronchus, trachea, kidney, and prostate. An important finding of this study was the dose-response found by both length of exposure and intensity of exposure (top or side of the ovens) for mortality from cancer of the lungs, bronchus, and trachea. A study of Japanese coke oven workers also found them to be at an excess risk of lung cancer mortality. British studies of cancer mortality in coke oven workers have generally been negative, but there were weaknesses in these studies. Coke oven emissions produce positive results in mutagenicity studies. Coal tar, a condensate of coke oven emissions, and various constituents of coke oven emissions have been found to be positive in both mutagenicity and animal carcinogenicity studies.

37170 **(PB—84-182211) NIOSH (National Inst. for Occupational Safety and Health) certified equipment list as of September 1, 1983.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Sep 1983. 335p. NTIS, PC A15/MF A01.

The September 1, 1983 list of NIOSH certified products for industrial hygiene and safety is presented. The products described in the list were tested, approved, and certified under authorization of the Federal Mine Safety and Health Act (MSHA) of 1977 and

the Occupational Safety and Health Act (OSHA) of 1970. The products which are designed for the control and evaluation of occupational hazards were tested to ensure that they met minimum performance requirements necessary to protect worker health and safety. The list contains tables of information concerning certified coal mine dust personal sampler units, detector tube units, sound level meter sets, and respirators. Components or replacement parts are also listed. Criteria for user selection of a unit for a particular task are presented. A listing of the manufacturers of the various units and components or replacement parts is provided. An updated list of applicants for certification and a list of test procedures for certification are also given.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 01700037163

37171 **(DOE/EIA—0493) National Coal Model (Version 5). User manual.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jun 1984. 122p. NTIS, PC A06/MF A01 - GPO; GPO Dep. Order Number DE84013926.

This manual provides a functional guide for users of Version 5 of the National Coal Model (NCM) System. With the aid of this document, the user can access the National Coal Model, select appropriate input files, and obtain the desired output reports. The manual is composed of the following information: an overview of the NCM system, a description of the system files, procedures for updating the data base, description and usage of keys and overrides, and procedures for using the NCM5 Execution Macros. The manual also contains a terminal operator's guide in Appendix A that describes how to access the EIA computer and log-on to SUPERWYLBUR. Sample output reports are included in Appendix B. The names, addresses, and telephone numbers of personnel to call for assistance are given in this chapter. These references are provided in case problems arise that cannot be resolved using this manual.

02 PETROLEUM

0201 Reserves

37172 **Naval petroleum reserves.** Washington, DC; Government Printing Office (1981). 117p.

A hearing to consider two bills (S. 1744 and H.R. 3023) authorizing appropriations to operate the Naval Petroleum Reserve during fiscal 1982 brought testimony from officials of the Departments of Energy and Defense; from Chevron, USA; and from the Independent Refiners Association. Both bills authorize $228,463,000, of which $2.56 million will be available for the naval oil shale reserves and the remainder for the naval petroleum reserves. Chevron spokesmen noted that 8-11 months were required to reach full production at the Elk Hills site rather than the 60-90 days estimated by DOE, although both Chevron and the Independent Refiners Association of the west coast support the President's decision that it is in the national interest to continue the production of crude from naval petroleum reserves for the next three years.

0202 Geology And Exploration

37173 **(DOE/SF/11564—9) Prediction of saturation using the carbon/oxygen log.** Horner, S.C.; Sanyal, S.K. (Stanford Univ., CA (USA). Petroleum Research Inst.). Sep 1984. Contract AC03-81SF11564. 39p. (SUPRI-TR—40). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012724.

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This project investigates the nature of Dresser-Atlas Carbon/Oxygen Log gamma ray spectra. It presents an attempt to improve the signal-to-noise ratio of the C/O and Si/Ca parameters used by Dresser-Atlas to determine oil saturation. Two techniques were developed to subtract the Compton background from the spectral data. Neither technique significantly improves the accuracy of the cased-hole prediction of oil saturation. However, it has been shown that it is possible to develop a satisfactory correlation for oil saturation on a well-by-well basis. This correlation can then be used to generate oil-in-place from the C/O and Si/Ca ratios. 17 references.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 02030038061, 38157, 38658

37174 **(DOE/BETC/OR—23) Amphiphilic compounds in enhanced oil recovery. Biennial report, October 1, 1980-September 30, 1982.** Ho, P.C.; Johnson, J.S. Jr. (comps.). (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84012719.

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Research results covering the final two years of this program are reported in four categories: phase studies; free energies; small-angle neutron scattering; and adsorption of inorganic ions on hydrous oxides. In the early years, distributions of cations between minerals and solutions covering the salinity range of formation waters were measured. Clays and hydrous oxides were emphasized because of their high ion-exchange capacity. The objectives were to determine the equilibria between sodium and hardness ions (particularly Ca(II)) because of their importance in modeling the solids as a source of troublesome multivalent ions. A further purpose on a collateral program was to evaluate the conditions under which the adsorption of potential tracers is low enough so that retardation of their movement relative to ground water is not great enough to impair their usefulness. From the beginning to the present, the properties of aqueous-hydrocarbon systems containing amphiphiles have been the major interest. The particular area we have emphasized is comparison of behavior when the organic-electrolyte amphiphile (protosurfactant) is of an equivalent weight lower than that necessary for formation of large micelles with that when it is in the surfactant range. In general, we have found surprisingly little qualitative difference between the two classes. Protosurfactants solubilize substantial amounts of hydrocarbons in aqueous medias, and cause the same types of phase behavior in compositions modeling micellar floods as surfactants. More recently, an increasing fraction of our effort has been in applying small-angle neutron scattering (SANS) to micellar systems and in further development of the techniques for doing so.

37175 **(DOE/SF/11564—8) Pulse testing in the presence of wellbore storage and skin effects.** Ogbe, D.O.; Brigham, W.E. (Stanford Univ., CA (USA). Petroleum Research Inst.). Aug 1984. Contract AC03-81SF11564. 361p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84012714.

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A pulse test is conducted by creating a series of short-time pressure transients in an active (pulsing) well and recording the observed pressure response at an observation (responding) well. Using the pressure response and flow rate data, the transmissivity and storativity of the tested formation can be determined. Like any other pressure transient data, the pulse-test response is significantly influenced by wellbore storage and skin effects. The purpose of this research is to examine the influence of wellbore storage and skin effects on interference testing in general and on pulse-testing in particular, and to present the type curves and procedures for designing and analyzing pulse-test data when wellbore storage and skin effects are active at either the responding well or the pulsing well. A mathematical model for interference testing was developed by solving the diffusivity equation for radial flow of a single-phase, slightly compressible fluid in an infinitely large, homogeneous reservoir. When wellbore storage and skin effects are present in a pulse test, the observed response amplitude is attenuated and the time lag is inflated. Consequently, neglecting wellbore storage and skin effects in a pulse test causes the calculated storativity to be over-estimated and the transmissivity to be under-estimated. The error can be as high as 30%. New correlations and procedures are developed for correcting the pulse response amplitude and time lag for wellbore

storage effects. Using these correlations, it is possible to correct the wellbore storage-dominated response amplitude and time lag to within 3% of their expected values without wellbore storage, and in turn to calculate the corresponding transmissivity and storativity. Worked examples are presented to illustrate how to use the new correction techniques. 45 references.

37176 **Experimental studies of in-situ microbial enhanced oil recovery.** Jenneman, G.E.; Knapp, R.M.; McInerney, M.J.; Menzie, D.E.; Revus, D.E. (Univ. of Oklahoma). *SPEJ, Society of Petroleum Engineers Journal;* **24**: No. 1, 33-37(Feb 1984).

Experiments were conducted to study the feasibility of using microorganisms in EOR, particularly for the correction of permeability variation. The use of microorganisms requires the ability to transport viable cells as well as the nutrients required for cellular growth through reservoir formations. Nutrients such as glucose, peptone-protein, and phosphate and ammonium ions were transported through brine-saturated Berea sandstone cores in amounts sufficient to support microbial growth. Viable bacterial cells were transported through sandstone cores of 170-md permeability. Less than 1% of the influent cell concentration was recovered in the effluent, indicating a high degree of cell retention inside the core. The addition of nutrients to these cores and subsequent incubation to allow for microbial growth resulted in permeability reductions of 60 to 80%. These data show that the growth of microorganisms significantly reduces the permeability of porous rock.

37177 **Alvord (3000 ft Strawn) LPG flood design and performance evaluation.** Frazier, G.D.; Todd, M.R. (Mitchell Energy Corp.). *Journal of Petrology;* **36**: No. 1, 119-131(Jan 1984).

Mitchell Energy Corp. has implemented a liquefied petroleum gas (LPG)/drive-gas miscible process in the Alvord (3000 ft Strawn) Unit in Wise County, TX, utilizing the U.S. DOE tertiary incentive program. The field has been waterflooded for 14 years and was producing near its economic limit at the time this project was started. This paper presents the results of the reservoir simulation study that was conducted to evaluate pattern configuration and operating alternatives to maximize LPG containment and oil recovery performance. Several recommendations resulting from this study were implemented for the project. On the basis of model predictions, tertiary oil recovery is expected to be between 100,000 and 130,000 bbl (15,900 and 20,700 m^3) or about 7% of the oil originally in place (OOIP) in the unit. An evaluation of the project performance through Dec. 1981 is presented. This portion of the paper was written after drive-gas injection had just been initiated and represents only a preliminary evaluation of the project. In July 1981 the injection of a 16% hydrocarbon pore volume (HCPV) slug of propane was completed. Natural gas is being used to drive the propane slug. A peak oil response of 222 B/D (35.3 m^3/d) was achieved in Aug. 1981 and production has since been declining. This compares with a peak rate of 400 B/D (63.6 m^3/d) during the waterflood, and an oil rate just prior to initiation of LPG injection of 7 B/D (1.1 m^3/d). The observed performance of the LPG flood indicates that the actual tertiary oil recovered will reach the predicted value, although the project life will be longer than expected. The results presented in this paper indicate that, without the DOE incentive program, the economics for this project would still be uncertain at this time.

37178 **New pressure transient analysis methods for naturally fractured reservoirs.** Serra, K.; Raghavan, R.; Reynolds, A.C. (Univ. of Tulsa). *Journal of Petroleum Technology;* **35**: No. 13, 2271-2283(Dec 1983).

This paper presents new methods for analyzing pressure drawdown and buildup data obtained at wells producing naturally fractured reservoirs. The model used in this study assumes unsteady-state fluid transfer from the matrix system to the fracture system. A new flow regime is identified. The discovery of this flow regime explains field behavior that has been considered unusual. The probability of obtaining data reflecting this flow regime in a field test is higher than that of obtaining the classical responses given in the literature. The identification of this new flow regime provides methods for preparing a complete analysis of pressure data obtained from naturally fractured reservoirs. Applications to field data are discussed.

0204 Processing

37179 **(MIT-EL—81-038WP) Aggregate supply model: documentation and use.** Ward, G.L. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1981. Contract AT01-80EI10681. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008887.

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This paper provides documentation of the Aggregate Supply Model, a computer-based model designed to forecast oil production capacity by producing region. The model is an inertial-process type model based on a few simplifying assumptions. These assumptions, plus key terms important for understanding the model, are described in this paper. Data requirements are identified and an example of results from a model simulation is presented. In addition, a technical description of both the model and the data is presented, along with a description of the computer code that implements the model.

0205 Products And By-products

REFER ALSO TO CITATION(S) 02050037078, 37079

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 02070037189

37180 **(DOE/EI/11972—T1) Consumer expectations for future gasoline prices.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). May 1983. Contract AC01-80EI11972. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014209.

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A key finding of this study is that consumer expectations respond to the volatility in retail gasoline prices. Historical price trends can be characterized as a series of rapid steps separated by varying periods of relative stability. The behavorial models investigated here imply that consumer response to downward steps is constrained by the effect of the longer-term (less volatile) trends. The response to upward steps is, however, essentially unconstrained in that it can be driven directly through the short-term price trend. The rough trajectory by which retail gasoline prices have climbed historically thus appears to sustain relatively high consumer expectations for future price levels. In a second point of divergence, analytical efforts also generally employ real price trends. While arguably the basis for decision-making by business planners and analysts, it does not necessarily hold that consumers discount nominal price trends for expected inflation rates in developing their year-ahead price forecasts. An initial review of the SRC data for expected real price increases (expected prices adjusted for the expected inflation rate) identified no consistent relationships, and generally lower correlations, with historical trends in real prices.

37181 **(DOE/EI/11972—T3) Gasoline price expectations.** Crawford, R. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 8 Oct 1982. Contract AC01-80EI11972. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014211.

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This paper examines the trends in consumer expectations for future retail gasoline prices as reported in the Automotive Consumer Profile (ACP) survey conducted by J.D. Power and Associates. In eight samplings over the period November 1979 through May 1982, consumers were asked what they currently paid for gasoline and what they expected to pay one year later. The nationwide averages for these reported current and year-ahead prices have been related to the historical average prices for all gasoline grades, as surveyed by the Bureau of Labor Statistics (BLS). The study suggests that consumers project gasoline price increases on the basis of: an underlying price inflation that is approximately the rate of increase in non-energy components of the CPI; plus the greater of the annualized price changes experienced over the short-term (past three months) and the long-term (past 16 months). This paper also makes a prediction of current consumer price expectations for com-

parison with results of the latest ACP, fielded in September 1982, to be released during October or early November.

37182 **(DOE/EIA—0035(84/04)) Monthly energy review, April 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Jul 1984. 126p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. Order Number DE84015303.

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The United States produced 7.7% more energy during the first 4 months of 1984 than during the same period in 1983, and US energy consumption was up 8.1%. Net imports of all energy were 41.0% higher, with net imports of petroleum up 43.5% compared to the first 4 months of 1983. Energy production during April 1984 totaled 5.3 quadrillion Btu, an 8.5% increase compared to the level of production during April 1983. Coal production increased 16.2% and natural gas production was up 13.7%, while petroleum production decreased 0.1%. Production of all other forms of energy combined increased 4.3% compared to 1 year earlier. Energy consumption during April 1984 totaled 5.8 quadrillion Btu, 5.5% above the level of consumption during April 1983. Coal consumption increased 9.5% petroleum consumption was up 5.4, and natural gas consumption increased 2.7%. Consumption of all other forms of energy combined increased 4.5% compared to consumption during April 1983. Net imports of energy during April 1984 totaled 0.7 quadrillion Btu, 14.2% above the level of imports during April 1983. Net imports of petroleum increased 19.0%, while net imports of natural gas decreased 2.9%. Net exports of coal were up 26.3% compared to the level in April 1983.

37183 **(DOE/EIA—0109(84/05)) Petroleum supply monthly, May 1984.** (USDOE Energy Information Administration, Washington, DC). Jul 1984. 83p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84015304.

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Summary statistics through June 1984 are presented for: crude oil and petroleum products; crude oil supply and disposition; crude oil and petroleum products imports; finished motor gasoline supply and disposition; distillate fuel oil supply and disposition; residual fuel oil supply and disposition; liquefied petroleum gases supply and disposition; other petroleum products supply and disposition; and sources.

37184 **(DOE/NBM—4013588) Three-region intertemporal model of energy, international trade and capital flows.** Manne, A.S.; Preckel, P.V. (Electric Power Research Inst., Palo Alto, CA (USA); National Science Foundation, Washington, DC (USA); USDOE, Washington, DC). Apr 1984. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013588.

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This paper reports on the formulation and solution of a three-region intertemporal equilibrium model of energy, international trade and capital flows. In order to focus upon international energy issues, the market economies are aggregated into three broad regional groupings: OECD, OPEC and NODC (non-OPEC developing countries). The first part of this paper, intended for policy-oriented readers, begins with a review of key assumptions, then describes three different types of applications: one dealing with OPEC and future world oil prices; another dealing with OECD demand elasticities; and the third with constraints on North-South capital flows. In all cases, a key role is played by the assumption of consistent expectations. That is, the identical price expectations are the basis for action on the part of each economic agent. Part II is more technical in nature. It illustrates the inclusion of dated commodities within an Arrow-Debreu framework. The intertemporal model is formulated in algebraic terms, and is then reduced in dimensionality for solution by a fixed-point method.

37185 **(DOE/NBM—4014200) Vehicle purchase behavior and auto use trend analysis.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Oct 1982. Contract W-31-109-ENG-38. 251p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84014200.

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Selected DOE data bases were consolidated, documented, and applied to pertinent transportation issues. The primary data base studied was the NFO/Auto-Facts Gasoline Diary Panel, a market research survey of US households from April 1978 through March 1981 recording over 733,000 fuel purchases for their household vehicles. Also documented was the J.D. Power/DOE New Vehicle Owner Survey, a survey of 10,630 buyers of new 1978 and 1979 cars and light-duty trucks on the importance of fuel economy to new vehicle buyers. The final data base of the study was the Transportation Panel of the Residential Energy Consumption Survey (RECS), which characterizes the broad spectrum of energy use in residential, commercial, industrial, and transportation sectors, using a stratified probability sample of fuel purchases for household vehicles. 5 figures, 28 tables.

37186 **(ST/CTC—29) Main features and trends in petroleum and mining agreements: a technical paper.** (United Nations, New York (USA)). 1983. 137p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84901348.

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An important mandate of the United Nations Centre on Transnational Corporations is to strengthen the negotiating capacity of host countries, particularly developing countries, in their dealings with transnational corporations. A significant aspect of the Centre's activities in this regard is the collection and analysis of information on legal and contractual arrangements between transnational corporations and host country institutions and enterprises. This report combines a survey of the major features and trends in the petroleum and mining industries on an interregional basis and is one in the series of studies relating to contracts and agreements. The objective of these studies is to identify the principal features and trends in contractual arrangements of particular types and in respect of specific sectors. The various provisions that have been described and analysed have been viewed in the context of the objectives sought to be achieved by such contractual arrangements. In the above context, the petroleum and mining industries, in which transnational corporations are actively involved, is of special importance to many countries, both developed and developing, as well as to oil-producing countries and those countries undergoing exploration. This present report focuses in particular on trends and features in the petroleum and mining industries in the 1970s and the changing roles and relationships between transnational corporations and host country Governments in the past decade as well as on discernible future trends.

0208 Waste Management

REFER ALSO TO CITATION(S) 02080037199

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 02090038387

37187 **(AD-A—138426/2) Revegetation and selected terrain disturbances along the trans-Alaska pipeline, 1975-1978.** Johnson, L.A. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Jun 1981. 122p. (CRREL—81-12). NTIS, PC A06/MF A01.

Revegetation techniques along the trans-Alaska pipeline as employed by Alyeska Pipeline Service Company during the 1975-1978 summers were observed. Objectives included determining the success of treatments, identifying problem areas, and noticing long-term implications. Observations and photographs at 60 sites located along the trans-Alaska pipeline indicated frequent occurrence of successful revegetation as well as frequent problems, such as erosion, slope instability, poor scheduling of seed application, occurrence of weed species, failure to optimally reuse topsoil and fine-grained soil, and low rates of native species reinvasion. Alyeska's visual impact engineering was observed to be very successful, as shown by high first-season survival. However, a related program for establishing willow cuttings was unsuccessful in 1977 but appeared very promising in 1978 largely due to improved management and more favorable growing conditions. Terrain disturbances due to the construction of the fuel gas line, snowpads, and oil spills were examined to identify and describe related environmental impacts on natural vegetation. Proper construction and use of snow-

pads minimized the extent and severity of disturbance. Crude oil spills, although damaging to vegetation did not cause total kill of vegetation, and certain types of spills may have only short-term effects. Results of restoration research by CRREL along the trans-Alaska pipeline are discussed.

37188 **(PB—84-195346) Waste oil heaters: organic, inorganic, and bioassay analyses of combustion samples. Report for Sep 82-Mar 84.** Cooke, M.; Bresler, W.E.; Hayes, T.L.; Hall, R.E.; Mumford, J.L. (Battelle Columbus Labs., OH (USA)). May 1984. 30p. NTIS, PC A03/MF A01.

The paper describes tests on two typical designs of waste-oil space heaters, firing two different types of waste crankcase oils. Study results can be summarized according to the four substances investigated: particulates, polynuclear aromatic hydrocarbons (PAHs), organolead, and fuel samples. Analysis of samples from the air atomizing heater (AAH) confirmed previously identified elevated metal content of waste oil emissions. Bromine levels were exceptionally high. The ferrous ion (Fe(II)) content in particulate samples from the AAH was very low. Several PAHs were at elevated levels in gaseous emissions from both space heaters: the vaporizing pot heater (VPH) emissions had the higher PAH content. No organolead was detected in emissions from the AAH (organolead analyses were not performed on the VPH emissions). Mutagenicity assays of the particulate and the XAD samples from both heaters were mutagenic and contained direct-acting mutagens: emissions from the VPH were the more mutagenic. Comparison of the two types of fuels showed that emissions from the automobile waste crankcase oil were consistently more mutagenic than those from the truck waste crankcase oil.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 02100037172

37189 **(GAO/RCED—84-78) Improvements needed in the Department of the Interior's measurement of offshore oil for royalty purposes.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 30 Apr 1984. 13p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760. Order Number TI84901685.

The Department of Interior has a responsibility to ensure that offshore oil sales volumes are properly reported and that the government's share in offshore resources is accurately measured and monitored. Interior's production measurement activities, however, have not assured that sales volumes - used as a basis for royalty payments to the government - are measured accurately. Based on the projections of the sample of meters examined, 32% of the required reports attesting to the accuracy of oil sales meters were not received during calendar year 1982 in the Gulf of Mexico Region. Further, Minerals Management Service (MMS) did not identify or follow up all instances where sales meters were out of tolerance, follow up to determine if meter corrections were made, or use information available concerning meter accuracy to ensure that proper sales volumes were being reported by operators for royalty determination purposes. As a result, during calendar year 1982 in MMS' Gulf of Mexico Region, about 106 million barrels of oil with royalty value of $571 million passed through meters that MMS had not assured were accurate. MMS officials in the Gulf of Mexico Region attribute the lack of oversight to insufficient personnel and other priorities and said that they recently have assigned two additional persons to help ensure that future meter testing reports are received and used. MMS has partially implemented a nationwide automated system to account for oil sales and royalties and is developing another nationwide system for reporting production. In addition, Interior plans to automate meter testing and run ticket information in MMS' Gulf of Mexico Region system. However, even with these automated systems, MMS will not be fully assured that the proper data are being used on run tickets unless they are matched with meter testing reports.

37190 **Preparing for the next energy crisis: DOE's management of the international oil-sharing test. Thirty-Eighth Report by the Committee on Government Operations, Ninety-Eighth Congress, Second Session, May 17, 1984.** Washington, DC; Government Printing Office (1984). 46p.

Simulated petroleum supply disruptions response by the International Energy Agency (IEA) revealed deficiencies in the coordination and personnel training of the supply-sharing program. Of particular concern to the Subcommittee was the administration's sole reliance on market forces, with no standby plans for reducing demand or allocating domestic supplies. Government Accounting Office officials who reviewed the Allocation System Test-4 (AST-4) concluded that DOE's response was inadequate to meet US supply obligations to its allies. Following a description of the IEA allocation system, the AST-4 scenario and management problems, and policy issues, the report recommends several steps to improve procedures. The report also notes that Energy Secretary Hodel has initiated an internal review of the AST-4 to find ways to improve emergency responses.

37191 **Oil shock: policy response and implementation.** Alm, A.L.; Weiner, R.J. (eds.). Cambridge, MA; Ballinger Publishing Company (1984). 248p. (CONF-8207110—). Ballinger Publishing Co., 54 Church Street, Harvard Square, Cambridge, MA 02138 . Order Number TI84013447.

From Energy security policy implementation issues conference - oil shock: policy response and implementation; Cambridge, MA, USA (15 Jul 1982).

This conference gathered representatives of executive and legislative branches of the federal government, business, academia, international organizations and the press to present and debate energy security policy and its implementation. Supply disruption is approached from three aspects: behavior of the oil market and oil industry; effects on the economy; and the role of the Strategic Petroleum Reserve. Individual papers are treated in the data bases. (PSB)

37192 **Oil Overcharges.** Washington, DC; Government Printing Office (1983). 1101p.

Eleven witnesses from DOE and other government agencies testified on DOE's record in pursuing cases in which oil companies and others violated the 1973 Emergency Petroleum Allocation Act and failed to comply with a new General Accounting Office decision that overcharged funds must be returned to the injured parties. A major concern is the reduced budget for DOE in 1984, and how the department can resolve 400 outstanding and possible future cases with a $7 million budget. Additional material and four appendices follow the testimony.

37193 **Tax treatment of producers of oil and gas.** Washington, DC; Government Printing Office (1983). 697p.

A two-day hearing on issues relating to the tax treatment of oil and gas producers focused on information relating to the nature and basis for differences in treatment. At issue was whether these differences create special preferences and whether a non-uniform code can be a good tax law. The 92 witnesses represented mineral and royalty owners, oil and gas producers, consumers, small and independent businesses, investors, and others. Eighteen additional submissions for the record follow their testimony.

0230 Properties

REFER ALSO TO CITATION(S) 02300037099

37194 **(NIPER—135-PPS-84/3) Motor gasolines, 1983-84.** Shelton, E.M. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jun 1984. Contract FC01-83FE60149. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84012718.

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Analytical data for 1795 samples of motor gasoline were collected from service stations throughout the country and were analyzed in the laboratories of various refiners, motor manufacturers,

chemical companies, and research institutes. The data were submitted to the National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma for study, necessary calculations, and compilation under a cooperative agreement the National Institute for Petroleum and Energy Research (NIPER) and the American Petroleum Institute (API). The samples represent the products of 72 companies, large and small, which manufacture and supply gasoline. These data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing districts into which the country is divided. A map included in this report shows marketing areas, districts, and sampling locations. The report also includes charts indicating the trends of selected properties of motor fuels since 1959. Twelve octane distribution percent charts for areas 1, 2, 3, and 4 for unleaded antiknock index (R + M)/2 below 90.0, unleaded antiknock index (R + M)/2 90.0 and above, and leaded antiknock index (R + M)/2 below 93.0 grades of gasoline are presented in this report. The antiknock (octane) index (R + M)/2 averages of gasoline sold in this country were 87.3 for unleaded below 90.0, 91,3 for unleaded 90.0 and above, and 88.8 for leaded below 93.0 grades of gasoline. 16 figures, 5 tables.

37195 **Stable carbon isotope compositions of crude oils: application to source depositional environments and petroleum alteration.** Sofer, Z. (Cities Service Oil and Gas Corp., Tulsa, OK). *American Association of Petroleum Geologists, Bulletin;* **68**: No. 1, 31-49(Jan 1984).

From American Association of Petroleum Geologists Southwest Section Meeting; Midland, TX (5 Feb 1984).

The carbon isotopic composition of the C/sub 15+/ saturate and aromatic hydrocarbon fractions and the gas chromatographs of the C/sub 15+/ saturate fraction of 339 oils were geochemically and statistically evaluated. Results of this study show that the average isotopic compositions of the C/sub 15+/ aromatic hydrocarbon fractions of oils sourced from terrigenous or marine organic matter are identical. The average isotopic composition of the C/sub 15+/ saturate fraction of oils derived from terrigenous organic sources is slightly more negative (0.9%) than the average for marine oils, but this difference is insufficient to be used as a reliable source indicator. The isotopic differences between oils sourced from terrigenous and marine organic matter do not manifest themselves in the range of absolute values of one oil fraction but rather in the isotopic relationship between the saturate and aromatic hydrocarbon fractions. The isotopic relationship is the following: Oils of terrigenous organic source: δ^{13}C/sub aro/ = 1.12 δ^{13}C/sub sat/ + 5.45; Oils of marine organic source: δ^{13}C/sub aro/ = 1.10 δ^{13}C/sub sat/ + 3.75. The difference between the two equations was evaluated statistically and a statistical parameter, CV (the canonical variable), CV = -2.53 δ^{13}C/sub sat/ + 2.22 δ^{13}C/sub aro/ -11.65, was used to distinguish between marine and terrigenous oils. CV values larger than 0.47 indicate predominantly a terrigenous organic source for the oil, whereas CV values smaller than 0.47 indicate mostly a marine organic source.

0240 Storage

37196 **(SAND—84-0568) Creep and creep modeling of three domal salts: a comprehensive update.** Wawersik, W.R.; Zeuch, D.H. (Sandia National Labs., Albuquerque, NM (USA)). May 1984. Contract AC04-76DP00789. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015755.

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Stress and temperature change tests are described to determine upper and lower bound of the rates of steady state creep for three domal salts. Results obtained are compared with published data for salt from the same sites and with two larger data sets for a bedded salt. The various data sets are then correlated in activation analyses and fitted by models for power-law creep, cross-slip, and dislocation glide to show that a cross-slip model yields the best and mechanistically most credible fit. This suggestion is consistent with limited substructure observations for one sample. No satisfactory fit was obtained for a two-mechanism model dislocation climb and cross-slip. Results described include stress drop measurements that demonstrate slow recovery. It remains to be proved if recovery of rock salt at low temperature will be complete, and if so, after how much strain. Although all creep data are described most satisfactorily in terms of cross-slip, power-law models continue to be good empirical approximations. Therefore, the further use of power-law creep equations to describe the steady state creep of rock salt in SPR design calculations is deemed justified. 58 references, 15 figures, 3 tables.

37197 **(SAND—84-1021) Finite element study of working level separation at the Weeks Island salt dome.** Preece, D.S.; Krieg, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015756.

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The Weeks Island salt dome has a former two-level room-and-pillar salt mine which is now filled with oil as part of the Strategic Petroleum Reserve (SPR). This study is a determination of the safe separation of the SPR level from a postulated outburst beneath it. A series of finite element structural analyses model the mine excavation, filling, outburst occurrence, and subsequent time until the year 2045 for various postulated separation distances. It is found that if the outburst is 100 ft or more from the SPR then there is no discernable effect on the SPR. If the outburst is only 50 ft below the SPR, then there is a discernable but nonthreatening effect. 21 references, 21 figures, 2 tables.

37198 **Status of the Strategic Petroleum Reserve.** Washington, DC; Government Printing Office (1983). 226p.

Thirteen witnesses testified at a hearing on the progress made on the Strategic Petroleum Reserve (SPR) program, which was instigated to prevent undue economic or political pressure on the US in the event of a future interruption of supplies. Despite its national security role, the SPR had been controversial. The resulting failure to meet funding and reserve goals is examined by representatives of industry, transportation interests, the underground storage industry, and government agencies, including DOE and the Government Accounting Office. Additional material submitted for the record follows the testimony.

0250 Combustion

REFER ALSO TO CITATION(S) 02500038152

37199 **(DOE/MC/15091—1612) Applicability of Japanese NO/sub x/ control in the US.** Slack, A.V. (SAS Corp., Sheffield, AL (USA)). Feb 1980. Contract AP21-80MC15091. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84009256.

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This report surveys the status of NO/sub x/ control for stationary sources in Japan and analyzes applicability of the technology in the US. The principal control methods used in Japan are combustion modification and catalytic reduction using ammonia as the reducing agent. Noncatalytic reduction with ammonia is used to a limited degree. Wet scrubbing methods have been tested but are so unpromising that the development work has practically stopped. The combustion modification developments are applicable in this country but may not be any more effective than methods already under development in the US. Catalytic reduction is fully applicable for oil firing but for coal-fired boilers much more development work is needed to answer the several remaining questions. The needed research is presented in some detail. 16 figures.

03 NATURAL GAS

0301 Reserves

37200 (DOE/EIA—0130(84/05)) Natural gas monthly, May 1984. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jul 1984. 147p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. Order Number DE84014786.

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Dry gas production during May 1984 was estimated at 1394 billion cubic feet (Bcf), 10.5% above May 1983. Consumption of natural gas during May 1984 was an estimated 1204 Bcf, 5.2% above the May 1983 level. Residential consumption in April 1984 was down 4.7%, commercial consumption was down 3.0%, industrial consumption was up 9.8%, and electric utility consumption was up 8.4%. The volume of working gas in underground storage reservoirs at the end of May 1984 was 17.1% below the May 1983 level. The average wellhead price of natural gas in March 1984 was $2.66 per thousand cubic feet (Mcf), up .054 from March 1983. In May 1984, the average residential price of natural gas was $6.17 per Mcf, down .034. The average wellhead price for natural gas purchases projected for June 1984 by selected interstate pipeline companies was $2.74 per Mcf, down .04. The average price projected for Old Gas in May 1984 was $1.42 per Mcf; for New Gas, $3.62 per Mcf; and for High Cost Gas, $5.16 per Mcf. In June 1983, the prices projected for Old Gas, New Gas, and High Cost Gas averaged $1.42, $3.42, and $6.63 per Mcf, respectively. 5 figures, 25 tables.

0302 Geology And Exploration

37201 (DOE/BC/10216—13) Relationship of pore structure to fluid behavior in low permeability gas sands. Final report. Morrow, N.R. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). 1984. Contract AS19-80BC10216. 143p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84012721.

This is the final report of a three-year project concerned with the pore structure of low permeability gas sands. The report is divided into five sections: (1) Pressure Sensitivity of Permeability, (2) Effects of Fluid, Confining Pressure, and Temperature on Absolute Permeabiities of Low Permeability Sandstones, (3) Effect of Acid Leaching and Presence of Fractures, (4) Adsorption, and, (5) Mathematical Modelling and Correlations. In the first section, a data base of core properties is developed with measurements of permeability vs. confining pressure for three suites of cores as the main feature. The third section describes an initial investigation into (a) the effects of removing carbonate cement by leaching cores with acetic acid, (b) the effects of calcite-filled fractures on permeability and pressure sensitivity. Dramatic increase in permeability and decrease in pressure sensitivity were observed to result from leaching. For cores containing calcite-filled fractures, it was found that the fracture was neither a permeability barrier to flow across the fracture or a highly conductive region for flow along the fracture. Results presented in the fourth section on relationships between relative pressure and amount of adsorption provide careful information about the existence and extent of microporous material contained in tight gas sands. The fifth section on mathematical modelling presents results in which the diffusive contribution to flow is calculated for crack-shaped pores in series, and for two- and three-dimensional networks. 93 figures, 20 tables.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 03030037126, 37178, 38157

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 03060037200

37202 (DOE/PE—0054) First report required by Section 123 of the Natural Gas Policy Act of 1978. (USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC). Jul 1984. 152p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015690.

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Section 123 of the Natural Gas Policy Act of 1978 (NGPA) requires the Department of Energy to submit two reports on the natural gas market to the President and Congress. This is the first report. This report examines the current conditions in the natural gas market and analyzes the future effects of three alternative natural gas policies in terms of prices, supply, demand, competitive conditions, market forces, and market equilibrium. The report concludes that gas prices will not rise significantly or fly up after January 1, 1985, when partial decontrol becomes effective under the NGPA. The report also concludes that current federal regulations have inhibited the gas market from responding efficiently to changing market conditions and that the entire Nation would benefit from comprehensive deregulation legislation in the following ways: economic benefits of $33.6 billion to $48.7 billion as a result of greater efficiency, higher domestic gas production, and lower payments for gas and oil imports; recovery of an additional 27 trillion to 48 trillion cubic feet of domestic low-cost, old gas supplies that would not be produced under the NGPA; lower consumer prices for natural gas - $0.56 per thousand cubic feet lower in 195 than under the NGPA, and $0.27 to $0.45 per thousand cubic feet lower from 1986 to 1995 than under the NGPA; higher levels of both domestic gas consumption and domestic gas production than under the NGPA; and greater flexibility in the gas market to adjust to changing circumstances, thereby preventing the recurrence of shortages and surpluses.

37203 Proposed changes to natural gas laws (Part 4). Washington, DC; Government Printing Office (1983). 651p.

A series of four hearings included the testimony of 43 witnesses from the petroleum industry, natural gas users, and the financial community. At issue were proposals to allow the renegotiation of old gas contracts and the possible chaos that might result, such as the need for a windfall profits tax on the old gas. Other issues were the effects that a gas price cap might have on exploration and production, take or pay requirements, and whether eliminating the Fuel Use Act would solve the latter issue and encourage exploration. Witnesses responded on these and other concerns. Material submitted by 19 others for the record follows the testimony.

37204 Energy and the aged: the impact of natural gas deregulation. Washington, DC; Government Printing Office (1983). 200p.

Energy Secretary Donald Hodel led a group of six witnesses at a hearing held to examine the potential impact of natural gas deregulation proposals on elderly consumers. The witnesses were asked to examine the impact of current price increases on residential users, review anticipated price changes for elderly consumers, and explore whether current resources to offset these impacts on low-income and elderly consumers are adequate. Hodel's testimony is followed by that of representatives of public utility commissions and consumer groups and by an appendix with analyses by the DOE and the National Consumer Law Center.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 03080038387

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 03090038658

37205 **(DOE/MC/14517—T1) Laboratory data in support of hydraulically fracturing EGSP NY well No. 3. Final report.** (Terra Tek, Inc., Salt Lake City, UT (USA)). Apr 1982. Contract AC21-80MC14517. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015218.

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By the results in this report, it appears that the Devonian shale formation in the EGSP NY No. 3 well maybe successfully hydraulically fractured using nitrogen foam as a fracturing fluid. However, overall success will be dependent on the degree of natural fracturing within the formation. Then, an induced fracture linking the areas of natural gas concentration to the wellbore can provide sufficient fracture conductivity for commercial production levels. If extensive fluid loss is experienced during treatment, irreparable damage to the fracture faces, both induced and natural, may limit the overall well productivity. 6 references, 6 figures, 5 tables.

37206 **(SAND—84-0016) Coupled gas flow/solid dynamics model for predicting the formation of fracture patterns in gas well simulation experiments.** Taylor, L.M.; Swenson, D.V.; Cooper, P.W. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015421.

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A two-dimensional finite element model for predicting fracture patterns obtained in high energy gas fracture experiments is presented. In these experiments, a mixture of propellants is used instead of explosives to fracture the rock surrounding the borehole. The propellant mixture is chosen to tailor the pressure pulse so that multiple fractures emanate from the borehole. The model allows the fracture pattern and pressure pulse to be calculated for different combinations of propellant mixture, in situ stress conditions, and rock properties. The model calculates the amount of gas generated by the burning propellants using a burn rate given by a power law in pressure. By assuming that the gas behaves as a perfect gas and that the flow down the fractures is isothermal, the loss of gas from the borehole due to flow down the cracks is accounted for. The flow of gas down the cracks is included in an approximate manner by assuming self-similar pressure profiles along the fractures. Numerical examples are presented and compared to three different full-scale experiments. Results show a good correlation with the experimental data over a wide variety of test parameters. 9 reference, 10 figures, 3 tables.

37207 **(SAND—84-0247) High energy gas fracturing development. Final report.** Cuderman, J.F. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 196p. (GRI—84/0090). NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84015691.

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A propellant-based fracture technology has been developed that permits control of pressure loading in a borehole in order to produce multiple fractures radiating from the wellbore. Between four and eight radial fractures are formed when a mixture of solid propellants is tailored to burn at a rate that produces a pressure pulse faster than the pulse needed to produce a single hydraulic fracture yet slower than the pulse that crushes the wellbore. The proper propellant mixture is determined using semiempirical models that predict fracture length, fracture orientation, radial stress and radial acceleration. Fracture kinetics are modeled by a finite-element model designed to predict the type of fracturing obtained, fracture length, fracture orientation, stress, and displacement. Application of the High Energy Gas Fracture (HEGF) technology to Devonian shale, where commercially economic production is dependent upon formation of conduits that enable natural gas to migrate from the shale's natural fractures into the borehole, boosted production from 6700 ft^3/day (2.20 x $10^{-3}m^3$/s) to 22,000 ft^3/day (7.21 x $10^{-3}m^3$/s). 25 references, 67 figures, 16 tables.

37208 **Hydraulic fracture propagation in layered rock: Experimental studies of fracture containment.** Teufel, L.W.; Clark, J.A. (Sandia National Laboratories). *SPEJ, Society of Petroleum Engineers Journal;* **24**: No. 1, 19-32(Feb 1984).

Fracture geometry is an important concern in the design of a massive hydraulic fracture for improved natural gas recovery from low-permeability reservoirs. Determination of the extent of vertical fracture growth and containment in layered rock, a priori, requires an improved understanding of the parameters that may control fracture growth across layer interfaces. We have conducted laboratory hydraulic fracture experiments and elastic finite element studies that show that at least two distinct geologic conditions can inhibit or contain the vertical growth of hydraulic fractures in layered rock: a weak interfacial shear strength of the layers and an increase in the minimum horizontal compressive stress in the bounding layer. The second condition is more important and more likely to occur at depth. Differences in elastic properties within a layered rock mass may be important-not as a containment barrier per se, but in the manner in which variations in elastic properties affect the vertical distribution of the minimum horizontal stress magnitude. These results suggest that improved fracture treatment designs and an assessment of the potential success of stimulations in low-permeability reservoirs can be made by determining the in-situ stress state in the producing interval and bounding formations before stimulation. If the bounding formations have a higher minimum horizontal stress, then one can optimize the fracture treatment and maximize the ratio of productive formation fracture area to volume of fluid pumped by limiting bottomhole pressures to that of the bounding formation.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 03100037193, 37202, 37203, 37204

0320 Transport, Pipelines, And Handling

37209 **(DOE/EIA—0449) Study of contracts between interstate pipelines and their customers.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jul 1984. 90p. NTIS, PC A05/MF A01 - GPO; GPO Dep. Order Number DE84015178.

This study examines contracts between interstate pipeline companies and direct-sale customers and between pipelines and local distributors for the ultimate sale of natural gas to end-users. Studies previously undertaken by the Energy Information Administration (EIA) have centered principally on the structure of contracts between the producers of the natural gas and the pipeline companies. One provision of these pipeline/distributor contracts which has received increasing attention is a minimum bill clause which requires a minimum payment to a pipeline irrespective of the quantity of gas taken by the distributor company. In a period of declining demand for natural gas, these minimum bill clauses become important, and can have a significant impact on prices to consumers. This report provides the results of a survey based on a sample of pipeline rate schedules on file at the Federal Energy Regulatory Commission (FERC) undertaken by EIA, and discusses the impact of a new rule promulgated by FERC which restricts the costs which can be recovered through minimum bills. The report is intended to be of interest to analysts in the natural gas industry, state and federal regulatory bodies, Congress, and the general public.

0350 Storage

REFER ALSO TO CITATION(S) 03500038152

04 OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 04000037035, 37036

37210 **(DOE/R8/01455—T1) Colorado oil shale development: information collection and dissemination. Final program status report.** (Colorado Dept. of Natural Resources, Denver (USA)). 23 May 1983. Contract FG48-80R801455. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015417.

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37211 **(DOE/TIC—3367-Suppl.2-Pts.1and2) Oil shales and tar sands: a bibliography. Supplement 2, Parts 1 and 2.** Grissom, M.C. (ed.). (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). Jul 1984. 587p. NTIS. Order Number DE83018001.

This bibliography includes 4715 citations arranged in the broad subject categories: reserves and exploration; site geology and hydrology; drilling, fracturing, and mining; oil production, recovery, and refining; properties and composition; direct uses and by-products; health and safety; marketing and economics; waste research and management; environmental aspects; regulations; and general. There are corporate, author, subject, contract number, and report number indexes.

0404 Oil Production, Recovery, And Refining

37212 **(CONF-831123—1) Experimental test program of the HYTORT feasibility study.** Rex, R.C. Jr.; Lynch, P.A.; Roberts, M.J.; Feldkirchner, H.L. (Hycrude Corp., Chicago, IL (USA); Institute of Gas Technology, Chicago, IL (USA)). Nov 1983. 9p. Institute of Gas Tech., 3424 South State St., Chicago, IL 60616. Order Number TI84901426.

From Eastern oil shale symposium; Lexington, KY, USA (13 Nov 1983).

In late 1980, a HYTORT process feasibility study was initiated to develop the necessary information for the design and construction of a demonstration module and to provide the basis for a preliminary commercial plant design and cost estimate. The study encompassed two major areas of experimental effort: a Bench-Scale Unit (BSU) test program directed toward process chemistry and a large-scale Cold-Flow Model (CFM) test program which addressed retort mechanical design issues. This paper describes portions of the experimental programs conducted in these areas, and the application of their results to commercial plant process designs and economics. The BSU tests examined the effects of hydrogen partial pressure, shale heat-up rate, maximum shale temperature, and shale mass flux on oil yields and oil quality. Portions of the BSU program were statistically designed. The BSU capacity is 250 pounds/hour. Early in the feasibility study, various retort configurations were reviewed and areas requiring experimental investigation to facilitate commercial-scale retort design were identified. An experimental program was developed to study various retort mechanical design areas, including solids distribution, gas distribution and gas zone-sealing. The program was conducted in a 6-foot-diameter, 80-foot-tall CFM testing facility with a nominal capacity of 1000 tons/day of oil shale. The BSU test results were utilized to specify the commercial plant process design and the CFM results demonstrated the commercial feasibility of the retort design. Utilizing currently available process technology, a conceptual commercial plant design was developed around the shale retorting section specified from the results of the feasibility study.

37213 **(DOE/ER/12096—1) Investigation of the extraction of hydrocarbons from shale ore using supercritical carbon dioxide. Final technical report.** (Energy and Environmental Engineering, Inc., Cambridge, MA (USA)). Feb 1984. Contract AC02-82ER12096. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013449.

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Using supercritical carbon dioxide as a solvent, hydrocarbons were extracted from oil shale at low temperature under moderate pressure. Operational variables were studied. The average amount of oil removed corresponded to about 1% of the organic matter of the shale. The maximum yield was 0.73 gallons of oil per ton of shale or about 1.3%. Water was extracted from the shale in greater amounts than was oil. Extraction at temperatures below 400°F did not produce high enough yields for the process to be commercially viable. Yield did increase with smaller particle size, increased time of extraction, increased temperature, and increased density of the solvent.

37214 **(DOE/FE/60177—1624) Investigation of tracer and steam tests on the Western Research Institute 150-ton retort.** Turner, T.F.; Moore, D.F.; Merriam, N.W.; Covell, J.R. (Western Research Inst., Laramie, WY (USA)). Apr 1984. Contract FC21-83FE60177. 68p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84013369.

Gas tracer and steam front velocities in addition to flow model calculations are used to characterize rubble bed structure in an oil shale retort. The gas tracer method is shown to have superior resolution to the steam front method in detecting rubble bed variations. The tracer method is potentially less expensive. Recommendations for further research are made.

37215 **Results of mathematical modeling of modified in-situ oil shale retorting.** Braun, R.L.; Diaz, J.C.; Lewis, A.E. (Lawrence Livermore National Laboratory). *SPEJ, Society of Petroleum Engineers Journal;* **24**: No. 1, 75-86(Feb 1984).

Lawrence Livermore Natl. Laboratory (LLNL) has developed a one-dimensional (1D) mathematical model to simulate modified in-situ (MIS) retorting of oil shale. In this paper the authors discuss application of the model to commercial-scale retorting conditions. The model was tested by comparing calculated values to those measured in experimental retort runs performed at LLNL. There was generally good agreement between the calculated and observed results for oil yield, temperature profiles, and the yields of most gas species. Retorting rates were generally overestimated by as much as 10%. The model is a useful tool for design and control of retort operations and to identify and interpret observations that differ from model predictions. The model was used to predict the results for MIS retorting on a commercial scale, focusing on larger retorts and larger shale particle sizes than could be investigated experimentally. Retort bed properties, particularly shale composition and particle size, play an important role in determining the recoverable fraction of oil. For a given shale composition, the inlet-gas properties can be selected to help control retort operations and to maximize oil yield. Extreme variations in oil shale grade that may be encountered as a function of depth can be dealt with by appropriate changes in the composition and flow rate of the inlet gas. In addition, it is shown that substituting oxygen diluted with steam or CO_2 (for air or air diluted with steam) can make significant improvements in the heating value of the effluent gas. Finally, the feasibility of retorting through a substantial interval of very low-grade shale is demonstrated.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 04050037099, 38032

37216 **(DOE/BC/10525—8) Mechanisms of syncrude/synfuel degradation. Second annual report, October 1, 1982-September 30, 1983.** Cooney, J.V.; Hazlett, R.N.; Beal, E.J. (Naval Research Lab., Washington, DC (USA). Chemistry Div.). May 1984. Contract AI19-81BC10525. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015206.

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Polar compounds have been isolated from two different shale sources by acid extraction and silica gel adsorption. The identification of the extract components was accomplished by combined gas chromatography - mass spectrometry. Accelerated storage sta-

bility tests employing these polar extracts as dopants indicated a range of activities with respect to the promotion of insolubles formation. Extracts comprised of nitrogen bases exhibited moderate activity. The greatest activity was found for highly polar extracts. The autoxidation of 2,5-dimethylpyrrole (DMP) in shale-derived diesel fuel has been examined by the techniques of x-ray photoelectron spectroscopy (XPS or ESCA), fluorescence-phosphorescence, and by monitoring rates of oxygen absorption by stressed fuel. High temperature (100 to 120°C) stress regimes in DMP-doped fuel samples displayed different kinetic behavior from that observed at 43 to 80°C, suggesting that mechanistic changes occurred at the higher temperatures.

0407 Health And Safety

37217 **Industrial hygiene aspects of underground oil shale mining.** Hargis, K.M.; Jackson, J.O. (Los Alamos National Lab., NM). pp 463-484 of Health issues related to metal and nonmetallic mining. Wagner, W.L.; Rom, W.N.; Merchant, J.A. (eds.). Boston, MA; Butterworth Publishers (1983). Contract W-7405-ENG-36.

Commercial oil shale mining will be conducted on a very large scale. Conventional mining techniques of drilling, blasting, mucking, loading, scaling and roof bolting will be employed. Room and pillar mining will be utilized in most mines, but mining in support of Modified In-Situ (MIS) retorting may also be conducted. Potential health hazards to miners may include exposure to oil shale dusts, diesel exhaust, blasting products, gases released from the oil shale or mine water, noise and vibration, and poor environmental conditions. Mining in support of MIS retorting may, in addition, include potential exposure to oil shale retort offgases and retort liquid products. Based on the very limited industrial hygiene surveys and sampling in experimental oil shale mines, it does not appear that oil shale mining will result in special or unique health hazards. Further animal toxicity testing data could result in reassessment if findings are unusual. Sufficient information is available to indicate that controls for dust will be required in most mining activities; ventilation will be necessary to carry away gases and vapors from blasting and diesel equipment; and a combination of engineering control and personal protection will likely be required to control noise. 33 references, 9 figures, 2 tables.

0409 Waste Research And Management

37218 **Identification of organic compounds in oil shale retort water by GC and GC-MS.** Stuermer, D.H.; Ng, D.J.; Morris, C.J.; Ireland, R.R. (Lawrence Livermore National Lab., CA). pp 383-397 of Atomic and nuclear methods in fossil energy research. Filby, R.H.; Carpenter, B.S.; Ragaini, R.C. (eds.). New York, NY; Plenum Publishing Corporation (1982). Contract W-7405-ENG-48.

A separation scheme is presented for the analysis of oil shale retort water by gas chromatography (GC) and gas chromatography - mass spectrometry (GC-MS). The scheme is based on liquid-liquid extraction, silica chromatography, argentation chromatography and alumina chromatography. Resulting fractions can be resolved by GC and GC-MS and several hundred compounds can be identified. Even so a large fraction of retort water contaminants will require new analytical techniques to handle non-volatile and reactive compounds. 5 references, 8 figures, 4 tables.

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 04100037123, 37217

37219 **(DOE/R8/01253—T1) Oil shale resource applications. Final narrative report.** (Colorado Dept. of Local Affairs, Denver (USA)). 1983. Contract FG48-80R801253. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015441.

Human services plans are being developed for the counties of Mesa, Garfield, and Rio Blanco that will facilitate the current and future provision of needed human services in the rapidly growing and/or declining oil shale areas.

37220 **(DOE/R8/07020—T1) Colorado oil shale development on policy and impact mitigation plan. Final report, March 31, 1980-November 30, 1982.** (Colorado Dept. of Highways, Denver (USA)). 1984. Contract FG48-80R807020. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015408.

The impacts of accelerated oil shale development in four northwestern Colorado counties, Moffat, Rio Blanco, Mesa, and Garfield are being monitored and managed through a grant to the Colorado Department of Highways.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 05000037537

37221 **(ZfK—510) Annual report 1982. Nuclear Fuel Research Department.** Nebel, D. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Oct 1983. 163p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84702579.

Short communications on research activities have been compiled under the following headings: oxide materials such as UO_2, UO_2-CeO_2, BeO, ZrO_2, ZnO; chemistry of solutions; materials investigations mainly relating to radiation effects of metallic materials; analytical chemistry; methods, devices and equipments. In a final chapter publications and lectures are included.

37222 **Nuclear age: power, proliferation, and the arms race.** Washington, DC; Congressional Quarterly, Inc. (1984). 253p. Congressional Quarterly Inc., 1414 22nd Street NW, Washington, DC 20037.

Beginning with a history of the atomic bomb, The Nuclear Age gives an unbiased explanation of the link between useful nuclear energy and destructive atomic weapons. It discusses the development of commercial nuclear power, and explains the industry's current economic woes. Later chapters deal with nuclear proliferation, the origins of the Cold War, and the developement of international safeguards on the manufacture of atomic weapons. The book describes in detail the causes and ramifications of the US-Soviet arms race, and outlines the fundamental questions a continued arms buildup will raise for generations to come. 157 references, 20 tables.

0501 Reserves

REFER ALSO TO CITATION(S) 05010037307

0502 Exploration

REFER ALSO TO CITATION(S) 05020038021

37223 **(GJBX—5(84)) Guide to data reports of the hydrogeochemical and stream sediment reconnaissance.** Averett, W.R. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Jul 1984. Contract AC07-76GJ01664. 228p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84014974.

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The Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) effort involved collection and analysis of samples of stream sediment, groundwater, and surface water from the 48 conterminous states and Alaska, to determine concentrations of uranium and other selected elements. The data were not expected to identify individual orebodies or deposits; rather, they were expected to help delineate geochemical provinces and suggest favorable areas in which studies should be conducted in more detail. This guide provides tabulations that may be useful in determining which geographic areas were surveyed during the HSSR effort and what information is available for those areas. When the survey was terminated in 1980, fieldwork ceased leaving some quadrangles incompletely sampled and some quadrangles in which no sampling was conducted. All the samples collected were analyzed, but no further sampling was conducted, nor will any be undertaken in the future.

This guide is directed toward any user of HSSR data, no matter how much or how little knowledge of the HSSR survey the user may already have. The emphasis is on the information that is available in reports issued as part of the HSSR effort. The data-tape repository, described later in this guide, may be more important to some users; information pertaining to the use of the data tapes is provided in the User's Guide to NURE HSSR Tape Formats (Zinkl and Brock, 1984). 11 references, 15 figures, 9 tables.

37224 **(INIS-mf—9000) Geological map of Kvanefjeld Tunnel 1:100. Geology of Kvanefjeld Tunnel.** Nyegaard, P. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). 1980. 84p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780477.

In connection with the Kvanefjeld uranium recovery project the Kvanefeld tunnel is mapped in 1:2000 scale. A geological map with a short description and a geochemical map with U and Th analyses from "chip samples" are included.

0504 Feed Processing

REFER ALSO TO CITATION(S) 05040037362

0505 Enrichment

REFER ALSO TO CITATION(S) 05050037355

37225 **(GA-C—17227) Photochemical uranium enrichment in solids. Final report, June 1, 1981-June 30, 1983.** Muller, C.H. III; Porter, J.T.; Ensberg, E.S. (GA Technologies, Inc., San Diego, CA (USA)). Aug 1983. Contract AT03-81ER10894. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014897.

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Sequential two-color experiments in uranyl formate show an order of magnitude improvement in separation when compared with previous GA single color results. Selectivity is probably maintained through the photoreaction and annealing steps and is approximately equal to the exposed sample spectral selectivity. Consequently, excitation transfer in the intermediate state does not appear to be responsible for loss of selectivity. Nonselective bimolecular chemistry may contribute to some loss of separation in our experiments. However, it is clear that contributions due to bimolecular chemistry can be minimized. Substantial improvements in separation may be possible by using a very narrow bandwidth laser ($<0.05\ cm^{-1}$) and by limiting photoproduct densities. Solid solutions may eliminate many detrimental product related broadening mechanisms and possible excitation transfer in the reactive states and allow even greater separation. Our results are very encouraging and they support continued efforts in solid state isotope separation. 13 references, 16 figures, 3 tables.

37226 **Authorizing appropriations for the Department of Energy for certain civilian energy programs for fiscal years 1985 and 1986, and for other purposes, Committee on Interior and Insular Affairs, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 21p.

The Committee on Interior and Insular Affairs recommends passage of H.R. 5369 authorizing appropriations for commercial nuclear programs under DOE and for the Power Marketing Administration. The committee endorses DOE's request for $3.269 billion, a $187.5 million reduction from 1984's budget. The report covers uranium enrichment and nuclear waste management in the nuclear programs, and notes that the power marketing administrations are net revenue producers. A section-by-section analysis indicates 1984 appropriations, 1985 requests and recommendations, and 1986 recommendations for each. It concludes with executive communications with Energy Secretary Hodel.

37227 **Uranium enrichment: investment options for the long term.** Washington, DC; Congressional Budget Office (1983). 81p.

Background paper.

The US government supplies a major portion of the enriched uranium used to fuel most of the nuclear power plants that furnish electricity in the free world. As manager of the US uranium enrichment concern, the Department of Energy (DOE) is investigating a number of technological choices to improve enrichment service and remain a significant world supplier. The Congress will ultimately select a strategy for federal investment in the uranium enrichment enterprise. A fundamental policy choice between possible future roles - that of the free world's main supplier of enrichment services, and that of a mainly domestic supplier - will underlie any investment decision the Congress makes. The technological choices are gaseous diffusion, gas centrifuge, and atomic vapor laser isotope separation (AVLIS). A base plan and four alternatives were examined by DOE and the Congressional Budget Office. In terms of total enterprise costs, Option IV, ultimately relying on advanced gas centrifuges for enrichment services, would offer the most economic approach, with costs over the full projection period totaling $123.5 billion. Option III, ultimately relying on AVLIS without gas centrifuge enrichment or gaseous diffusion, falls next in the sequence, with costs of $128.2 billion. Options I and II, involving combinations of the gas centrifuge and AVLIS technologies, follow closely with costs of $128.7 and $129.6 billion. The base plan has costs of $136.8 billion over the projection period. 1 figure, 22 tables.

37228 **Enriched-uranium production planning.** Hatch, D.E.; Levin, S.A. (Oak Ridge Gaseous Diffusion Plant, TN). *Nuclear Applications and Technology;* 7: 259-269(Jul 1969).

The economics of enriched-uranium production in USAEC facilities have been analyzed and the equations of an optimizing economic model of the enriched-uranium industry developed. The objective function that is minimized by the model is the present value of the combined controllable costs of the USAEC and of the users of enriched uranium. The economic system considered is thus unusually comprehensive and the optimization problem correspondingly complex. A basic consideration in developing the optimum operating strategy is that the existing AEC investment in diffusion plant and feed stockpiles may be used to preproduce economically some of the future requirements for enriched uranium. The model has been used extensively in USAEC enriched-uranium production planning.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 05070037330, 37331

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 05080037256, 37296, 37658

37229 (INIS-mf—8961, pp 114-131) **Nondestructive methods of determination of isotope composition and burnup of spent fuel from WWER-type reactor.** Bibichev, B.A.; Kazarinov, N.M.; Majorov, V.P.; Fedotov, P.I. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Application of the nondestructive methods of analysis (NDA) being used for determination of burnup and isotope ratio as well as composition of spent fuel elements in the fuel assemblies of WWER-type reactor are discussed. Results are discussed which have been obtained by means of the γ-spectrometric method. Prospects are noted of a semiempiric method of determination of the burnup and isotope ratio of the fuel in WWER-type reactors. This method is based on the combination of the data which have been obtained by the γ-spectroscopy and of calculation. NDA has been considered which is based on the registration of self radiation of neutrons from spent fuel elements and assemblies. This method has some advantages as compared to the γ-spectrometric one, in the case of it's further elaboration, application of the neutron passive method both in the fuel cycle and in the safeguard system. In the

conclusion, prospects are discussed of development and application of the NDA for spent fuels from nuclear power plants. 17 references, 8 figures, 6 tables.

37230 (INIS-mf—8961, pp 132-147) **Destructive methods of determination of fuel burnup in thermal reactors.** Krtil, J.; Sus, F. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Review of publications has been given in the paper which are dealing with main methods used for determination of the burnup degree in nuclear fuels. First of all, attention is paid to the methods which ensure the highest accuracy in determination of the burnup magnitude. In details some of the stages are discussed in application of the analytical methods for determination of the fuel burnup. These methods are discussed both from methodologicat point of view and in the experimentat respect. Estimation has been given of these methods from the point of view of precision of the result which can be obtained. The review has summarized publications in the field of determination of the fuel burnup degree which have been published during last five-year period and gives them estimations. 98 references

37231 (INIS-mf—8961, pp 196-202) **Determination of burnup balance for nuclear reactor fuel on the basis of γ-spectrometric determination of fission products.** Bolovich, V.; Krits, J.; Sus, F.; Maksimovich, Z.; Klosova, Eh. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Results are given of experimental investigations in one of the versions of the method for determination of the balance of nuclear fuel burnup process by means of the γ-spectrometry of fission products. In the version being considered a balance of the burnup process was determined on the base of ^{106}Ru, ^{134}Cs. Activity was measured by means of a γ-spectrometer with Ge counter. Investigations were done on the natural uranium metal fuel from the heavy-water moderated reactor of the first Czechoslovakian nuclear power plant A1 in Yaslovske Bohunice. Possibility was checked of determination of the fuel burnup depth as well as of the isotope ratio and content of plutonium. Results were compared with the control data which had been obtained on the base of the mass-spectrometry of U, Pu and Nd. The reasons for deviations were estimated in the cases when they were greater than error in the control data. 15 references, 3 tables.

37232 (INIS-mf—8961, pp 204-206) **Correlation between burnup and concentrations ratio of ^{154}Eu/^{137}Cs.** Bernard, R.; Graber, Kh. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Intercommunication between the relation of ^{154}Eu/^{137}Cs concentrations and the burnup which had been found by measurements being conducted on the fuel assemply from the reactor of Rajnsberg nuclear power plant (20% enrichment) has been proven quantatively by means of calculations which had been performed using computation computer code ISOTOP. Results of the investigations which had been done up to now have shown that good proportionality is observed of both magnitudes up to the burnup of 2.5% and does not depend on the process of irradiation during the typical regime of operation of a water-water type reactor. The correlation permits determination of the burnup on the basis of the relative γ-spectrometric measurements after the long-term fuel cooling.

37233 (INIS-mf—8961, pp 232-237) **Investigations on development of methods for determination of rare earths sum in technological solutions of reprocessing of spent nuclear fuel from nuclear power plants.** Mokhai, M.; Chevari, M.; Akopov, G.A.; Malyshev, N.A. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Methodology is described in the paper for determination of the sum of the rare earth elements in the refined solution and in the initial solutions of the spent fuel reprocessing process. This methodology consists of separation of the microamounts of uranium on an ion-exchanger and determination of the optical density of the arsenazo-3 - rare earths complex by means of sodium hexametaphosphate being used as a masking agent. 5 references, 4 figures.

37234 (INIS-mf—8961, pp 238-243) **Correlation between europium isotopes ratio in irradiated nuclear fuel from Czechoslovakian nuclear power plant A1.** Smulek, V.; Krtil, J.; Bulovich, V.; Klosova, Eh. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Dependance was investigated of ^{154}Eu/^{155}Eu from the burnup in the samples of irradiated fuel from the nuclear power plant A1. Europium isotopes in the irradiated fuel were determined by means of the γ-spectroscopy after their separation by means of extraction chromatography. Burnup was determined on the basis of analysis of ^{137}Cs. Possibility was discussed of determination of the burnup on the basis of the above mentioned relation. 5 references, 3 figures, 2 tables.

37235 (INIS-mf—8961, pp 244-256) **Application of isotope correlation method for express determination of spent fuel parameters.** Khermann, A. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Results have been given of investigations on the linear correlations between the relations of nuclides of heavy elements content from one side and the relations of the content of fission products and relative content of plutonium from the other side. On the basis of the isotopic correlations which had been found, it was proved that there is a possibility for determination of both isotopic composition of uranium and plutonium in the spent fuel from the WWER-type reactor. Interrelations have been investigated on accumulation of some isotopes of uranium and plutonium. 7 references, 9 figures, 5 tables.

37236 (INIS-mf—8961, pp 258-267) **Experience in application of stable isotopes of ruthenium and molybdenum as burnup monitors.** Khermann, A.; Stefan, Kh.; Bell, G. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Results have been given in the paper of works on determination of the burnup degree by means of application of stable isotopes of ruthenium and molybdenum. Methodology has been given for separation of the burnup monitors from solutions of nuclear fuel as well as for the mass-spectrometry isotopic analysis of the fragmental ruthenium and molybdenum. Results of the analysis have been given. 10 references, 5 figures, 3 tables.

37237 (INIS-mf—8961, pp 284-288) **Mass-spectrometric determination of isotope ratio of uranium and plutonium in mixture of both elements.** Sus, F.; Klosova, Eh.; Shtepankova, E.; Fran'kova, V. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Mass-spectrometric determination of uranium and plutonium isotope ratio in the mixture of both elements is described in the paper. This method is used for determination of uranium and plutonium isotope ratio in nuclear fuels. In this case both elements are separated from the fuel samples and are analyzed jointly. It is possible to determine by this method uranium and plutonium concentrations when applying the methodology of mass-spectroscopy and isotopic dilution. Advantages of the method being described is that it simplifies separation of isotopes as well as makes analysis quicker and cheaper. 7 references.

37238 (INIS-mf—8961, pp 306-313) **Application of PDP-11/45 computer in spectrometry of ionizing radiations.** Kezhek, J.; Parus, Yu.; Zalevski, Ya. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

This work has been performed in the framework of solving the general problem of creation of a computer system for serving technological installations for reprocessing of irradiated nuclear fuel. The central element of this system is PDP 11/45 mini-computer which is equipped by devices both for off-line and on-line operations. The set of devices consists of: analog-to-digital system PDP-11; cassette controller of KAMAK 11 F-P system; interface of multi-channel amplutude analyzer. Principles of connection of the computer to multi-channel amplutude analyzers DIDAC-4000 and model 6240 (ORTEC, USA) which register amplitudes of pulses having been generated by electromagnetic radiation detectors have been stated in the paper. ORTEC analyzer has been connected by means of the modified interface, and analyzer 6240 by means of the KAMAK system using the input register 305 and hours generator 730 made by the POLON firm. Transmission of data to the computer is done by means of a computer code which had been written on FORTRAN and is using bit operations. When formed the data are transmitted into the program of spectra analysis.

37239 (INIS-mf—8961, pp 328-334) **Gamma-spectrometric method for control of composition of radionuclides in technological products from reprocessing of spent nuclear fuels.** Gofman, F.Eh.; Zavorotkin, A.A.; Mosyazh, V.M.; Orlov, V.I.; Tikhonova, A.E. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Results have been stated in the paper of development and application of the γ-spectrometric method which is based on the Ge(Li) detectors of the coaxial type. This method is used for control of composition and content of the actinide elements and fission products during technological investigations on the amalgamated laboratory installation SU-2 of the Khlopin Radium Institute. In the course of some of technological experiments the load on the spectrometer was up to 10 analysis per hour. Common magnitude of exposure was of 3-5 minutes. In some cases time of exposure was increased up to 20 minutes.

37240 (INIS-mf—8961, pp 336-341) **Determination of Pd(2) and Rh(3) in model Purex solutions by means of kinetic-spectrophotometric method.** Gorskij, N. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Results are stated in the paper of application of the spectrophotometric method for determination of the Rh(3) and Pd(2). Rhodium and palladium were determined in the model non-radioactive Purex solutions. A colored reagent bismuthol was used. Investigations which had been conducted have shown that this method is suitable for the analytical determination of rhodium and palladium in the Purex solutions. To make the calibration curve by means of the method which has been described in the paper and in applying glycerin it is possible to reach accuracy of determination for palladium of 5% and for rhodium of 10%.

37241 (INIS-mf—8961, pp 16-25) **Problems of reprocessing of irradiated fuel from thermal reactors.** Galkin, V.Ya.; Dubrovskij, V.M.; Zemlyanukhin, V.I.; Lazarev, L.N.; Lyubtsev, R.I.; Romanovskij, V.N.; Tikhonov, N.S. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

A review has been done in the paper on research and design works which had been done in the CMEA member-states during period of 1976-1979 on the problems connected with reprocessing of irradiated fuel elements of thermal nuclear power plants. It has been shown that the main themes of investigations in this field were decladding of irradiated fuel elements and their preparation for reprocessing; improvement of technology and creation of equipment for regeneration of spent fuel elements of WWPR (water-water power reactors) type; development of methods and instruments for control and management of technological processes of regeneration. Results have been given of development of technology and creation of equipment for decladding of fuel elements; non-stop dissolving of fuel elements; clarification of initial technological solutions. Works have been considered on investigation of redox reactions of actinides; phase transformations kinetics in extraction of actinides and fission products; chemical and radiation properties of new extractents and dilutors; extraction composition of tributyl phosphate with dilutor; theory of extraction development of some types of equipment, methods and instruments of laboratory and remote control of valuable elements content in the solution; remote control and management of technological processes of reprocessing of irradiated fuel elements. Estimation has been given of the works which had been done and directions of their future development have been outlined.

37242 (INIS-mf—8961, pp 168-170) **Methods of fluorides for reprocessing of spent fuels.** Peka, I. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Published data have been given in the paper dealing with development of the fluoride method for reprocessina of spent nuclear fuels. These data had been published in 1977-1980 in France, Japan, USSR and Czechoslovakia. Development of the technological process for reprocessing of the mixed fuel UO_2-PuO_2 has been practically finished. Now attention is paid to the design development of some apparatuses. The technological process which had been proposed has been checked by means of reprocessing of the real spent fuel in pilot-plant scale. In this case yield of U and Pu was nearly 99%. In laboratory scale the problem has been solved of removal from plutonium of ruthenium, which because of similar chemical reactions, poisoned Pu. Also the problem has been solved of isolation of U and transplutonium elements from the nonvolatile fission products in the medium of molten fluoride salts.

37243 (INIS-mf—8961, pp 88-113) **Control system in extraction reprocessing of spent nuclear fuel.** Lazarev, L.N.; Lyubtsev, R.I.; Orlov, V.I.; Akopov, G.A.; Gofman, F.Eh.; Ryazantsev, V.I.; Samsonenkov, V.S.; Rrivokonev, A.T. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

A control system is considered as an information system which is the base of automatic control of technological processes of reprocessing of spent nuclear fuels. General layout of means of control both remote and laboratory ones, conformably to main tasks are discussed: operation guidance; control of technical and economic indices and balance; prevention of the nuclear-hazard situations. Analysis of the methods of remote control is conducted from the point of view of guidance of main extraction operations and prevention of the nuclear-hazard situations. The list is given of main laboratory methods conformably to the above listed tasks. Problems which have not been solved in the field of development of the methods and control systems as a whole as well as directions for their solution on the nultilateral basis are discussed.

37244 (INIS-mf—8961, pp 26-37) **State of investigations in reprocessing of fuel elements from nuclear power plants with fast reactors.** Zemlyanukhin, V.I.; Nikiforov, A.S.; Novoselov, G.P.; Prusakov, V.N.; Skiba, O.V.; Tsarenko, F.F.; Shmidt, V.S. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Review is given in the paper of new data obtained in the field of aqueous and non-aqueous methods of reprocessing of fuel elements from fast reactors. Data are given for aqueous methods on following problems: methods of calculation of distribution of valuable components in the process of counter current extraction (taking into consideration new data on distribution of 6-valency elements); behaviour of some elements which are products of decay in the course of extraction, including new data on extraction of lead; behaviour of ions of fluorine during extraction in the conditions of reprocessing fast reactor fuel elements; condition for separation of the third phase an extractaon; chemistry of processes of dissolving of fast reactor fuel elements; problems of radiation stability of extragents and radiation transformations of aqueous phase in the conditions of reprocessing. As to the non-aqueous methods, following problems are discussed; fission products distribution in fuel elements; new data on thermal decladding of fuel elements with mixed fuel. In conclusion, main directions are considered in the paper of future investigations on the technology of reprocessing of fast reactor fuel elements.

37245 (INIS-mf—8961, pp 268-275) **International comparative experiment SPOK-2.** Sus, F.; Krtil, J.; Moravets, Ya.; Malek, Z. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Results are stated of the second stage of the analytical investigation on the components of irradiated fuel's solution from the WWER-type reactor. Concentration of ^{137}Cs has been determined by means of the γ-spectrometry and concentration of ^{148}Nd by means of the mass-spectrometric method of isotopic dilution. Eight laboratories from six CMEA member-states took part in the experiment. Correctness of application of both analytical methods have been proved. The mass-spectrometric method is suitable mainly for calibration measurements.

0509 Transport And Storage

37246 (INIS-mf—8961, pp 78-87) **Problems of spent nuclear fuel transportation.** Fisher, V.; Rudol'f, K.; Ershov, V.N.; Kalinin, B.V.; Kozlov, Yu.V.; Kondrat'ev, A.N.; Yulikov, E.I. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Experience in transportation of spent fuel assemblies from nuclear power plants Novovoronezhskaya, Rajsberg and Bruno Lejshner have been analysed in the paper. Proceeding from the experience in transportation from these nuclear power plants, tasks have been formulated, which have to be solved for ensuring more effective transportation of spent fuels. Data are given on results of testing of new transport packing set as well as of a car which is intended for transportation of spent fuels from nuclear power plants of the CMEA member-states which have WWER-440 reactors. Main directions and results of the finished stages of works dealing with transportation of spent nuclear fuel which have been conducted in the USSR and DDR, are considered in the paper. In particular, results are stated of works which are going on: investigation in conditions of transportation of nuclear fuel with damaged fuel elements; investigation in the thermal regime of casks in the conditions of "wet" and "dry" transportation, including investigation of resistivity of fuel assemblies in gas and water wapor media at elevated temperatures; investigation in durability of transport casks; analysis of problems of nuclear safety of packages in normal and accidental conditions of transportation; investigation of danger of explosion of gas mixture in water-filled casks; investigation and analysis of conditions of spent fuel transportation by water transport.

37247 **(NUREG—0725-Rev.4) Public information circular for shipments of irradiated reactor fuel. Revision 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards). Jun 1984. 87p. NTIS, PC A05/MF A01 - GPO* $7.00. Order Number TI84901643.

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This publication is the fifth in a series of annual publications issued by the Nuclear Regulatory Commission in response to public information requests regarding the Commission's regulation of shipments of irradiated reactor fuel. This publication contains basically three kinds of information: (1) routes recently approved (18 months) by the Commission for the shipment of irradiated reactor fuel; (2) information regarding any safeguards-significant incidents that may be (to date none have) reported during shipments along such routes; and (3) cumulative amounts of material shipped.

37248 **(NUREG/CR—3658) Considerations relevant to the dry storage of LWR fuel rods containing water.** Woodley, R.E. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76FF02170. 34p. (HEDL-TME—84-14). NTIS, PC A03/MF A01 - GPO $3.75. Order Number TI84015220.

The performance under dry storage conditions of LWR fuel rods containing water was analyzed to determine if radionuclide containment by the fuel rod cladding would be adversely affected. Fuel rod and storage canister pressurization, as well as cladding and fuel oxidation, were examined using worst-case conditions. The results of this study are presented. 12 references, 4 figures, 4 tables.

37249 **(PNL—5109) Characterization of LWR spent fuel MCC-approved testing material-ATM-101.** Barner, J.O. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 216p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84014874.

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The characterization data, obtained to date, for Materials Characterization Center (MCC) Approved Testing Materials (ATM)-101, spent fuel from H.B. Robinson, Unit 2, Assembly BO-5, are described. ATM-101 consists of 27 equal-length segments from nine fuel rods. Characterizations provided for ATM-101 include, (1) reactor, assembly, and fuel rod descriptions, (2) Assembly BO-5 irradiation history, (3) a description of unusual incidents that occurred to the rods, (4) fission gas release measurements, (5) results of ceramography/metallography examinations, (6) fuel burnup measurement results and correlations, (7) results of gamma scanning, (8) calculated values of the radionuclide inventory, and (9) results of a radionuclide chemical overcheck. Calculations for and measurement of radial distributions of selected radionuclides are planned. A description of pertinent results from other studies on sibling rods from Assembly BO-5 is also included. The distribution of ATM-101 to date is described along with characterization results on specially processed material. It is intended that this report be revised and updated as additional characterization data become available. 6 references, 23 figures, 19 tables.

37250 **(PNL—5176) Evaluation of concepts for monitored retrievable storage of spent nuclear fuel and high-level radioactive waste.** Triplett, M.B.; Smith, R.I. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1984. Contract AC06-76RL01830. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015207.

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The primary mission selected by DOE for the monitored retrieval storage (MRS) system is to provide an alternative means of storage in the event that the repository program is delayed. The MRS concepts considered were the eight concepts included in the MRS Research and Development Report to Congress (DOE 1983). These concepts are: metal cask (stationary and transportable); concrete cask (sealed storage cask); concrete cask-in-trench; field drywell; tunnel drywell; open cycle vault; closed cycle vault; and tunnel rack vault. Conceptual design analyses were performed for the candidate concepts using a common set of design requirements specified in consideration of the MRS mission.

37251 **Handling encapsulated spent fuel in a geological repository environment.** Ballou, L.B. (Lawrence Livermore National Lab., CA). pp 463-472 of Radioactive waste management. Volume 3. Proceedings of an international conference held by the IAEA in Seattle, 16-20 May 1983. Vienna, Austria; IAEA (1984). (CONF-830523—).

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

In support of the Spent Fuel Test-Climax at the United States Department of Energy's Nevada Test Site, a spent fuel canister handling system has been designed, deployed and operated successfully during the past five years. This system transports encapsulated commercial spent fuel assemblies between the packaging facility and the test site (approx. 100km), transfers the canisters 420m vertically to and from a geological storage drift, and emplaces or retrieves the canisters from the storage holes in the floor of the drift. The spent fuel canisters are maintained in a fully shielded configuration at all times during the handling cycle, permitting manned access at any time for response to any abnormal conditions. All normal operations are conducted by remote control, thus assuring 'as low as reasonably achievable' exposures to operators; specifically, there have been no measurable exposures during 30 canister transfer operations. While not intended to be prototypical of repository handling operations, the system embodies a number of concepts now demonstrated to be safe, reliable and economical, which may be very useful in evaluating full-scale repository handling alternatives in the future. Among the potentially significant concepts are: use of an integral shielding plug to minimize radiation streaming at all transfer interfaces; hydraulically actuated transfer cask jacking and rotation features to reduce excavation headroom requirements; use of a 'dedicated' small diameter (0.5m) drilled shaft for transfer between the surface and repository workings; a wireline hoisting system with a positive emergency breaking device that travels with the load; remotely activated grapples, three used in the system, which are insensitive to load orientation; rail-mounted underground transfer vehicle operated with no personnel underground.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 05100037186, 37227, 37257, 37283

0520 Waste Management

REFER ALSO TO CITATION(S) 05200037226, 37250, 37341, 37342, 37343, 37346, 37347, 37348, 37350, 37351, 37352, 37353, 37357, 37358, 37565, 37658, 38658

37252 **(AERE-G—2779) Electrical processes for the treatment of medium active liquid wastes: a laboratory-scale evaluation. Final report January 1981-March 1983.** Turner, A.D.; Bowen, W.R.; Bridger, N.J.; Harrison, K.T. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Oct 1983. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84702574.

A wide range of electrochemical separation processes has been evaluated through literature and experimental studies for potential application to the treatment of medium-active liquid wastes. Of the ten processes considered, electro-osmosis and electrochemical ion-exchange show the most promise for immediate further development to a larger scale, while the faradaic deposition of PuO_2, Tc, RuO_2 require further laboratory study before judgement can be passed on these. Electro-osmosis has an exceptionally high solids retention (99.99%) and is capable of dewatering suspensions to 35% - suitable for direct incorporation in concrete. Electrochemical ion-exchange has the attractions of a conventional ion-exchange process but with the added features of enhanced kinetics and pH operating range, as well as elution into demineralized water merely by polarity reversal. All electrical processes have the advantage of the added process variable of externally applied potential, which can enable remote, automatic control.

37253 **(AERE-G—2856) Corrosion studies on containment materials for vitrified high level nuclear waste. Progress report for half-year ending 30 June 1983.** Taylor, K.J.; Bland, I.D.; Westcott, C.; Marsh, G.P.; Harker, A.H. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Dec 1983. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84702560.

Progress is reported on a research programme designed to identify containment materials that could be used to isolate nuclear waste for 500 to 1000 years after disposal. The main emphasis in this reporting period has been on the general corrosion of carbon steels selected as candidates for corrosion allowance containers. Carbon steel coupons embedded in crushed granite under aerated synthetic granite ground water at 90 deg C for six months exhibited a general corrosion rate of about 20 $\mu m\ yr^{-1}$. Eighteen additional long term tank immersion tests are in progress to investigate the corrosion behaviour of plain and welded carbon steel samples under a range of experimental conditions. Experiments with carbon steel exposed for 7500 hours to deaerated seawater at 90 deg C demonstrated that the maximum general corrosion rate was $< 10\ \mu m\ yr^{-1}$ in the absence of oxygen. Preliminary results from identical experiments conducted in a low dose rate cobalt-60 radiation cell indicate that this rate of corrosion was unaffected by a radiation dose of 285 Rh^{-1}. A mathematical model has been formulated to describe the general corrosion behaviour of carbon steel containers buried in an environment typical of a waste repository. This has indicated that the long term general corrosion rate will settle at approx. 3.5 $\mu m\ yr^{-1}$.

37254 **(AERE-G—2927) Electrical processes for the treatment of medium-active liquid wastes. Annual progress report January-December 1983.** Turner, A.D.; Bowen, W.R.; Bridger, N.J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Dec 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702575.

Following the completion of a laboratory scale evaluation of electrochemical processes for the treatment of medium-active liquid wastes, electro-osmotic dewatering and electrochemical ion-exchange have been selected for further development and scale-up. A 20x scaled-up electro-osmotic dewatering cell has been designed and constructed and is currently undergoing tests using a ferric hydroxide settled slurry feed. Initial trials have raised the solids contents from 1 to 10% with further increases possible. The electrochemical control of fouling at cross-flow filter membranes is also being investigated. The settling and electrical dewatering properties of ferric hydroxide sludges have also been investigated as a function of flocculating conditions. Precipitation at approx. pH 10 gives optimum supernate clarity and settling rate, while the presence of Ca^{2+}, Mg^{2+}, SO_4^{2-}, PO_4^{3-} significantly increase the efficiency of subsequent electro-osmotic dewatering. An electrochemical ion-exchange flow cell has been designed and built. Even this preliminary design gives a Cs DF of 2000 on a single pass up to breakthrough occurring when 75% of the adsorber capacity has been utilized. Significant concentration factors were obtained on elution into water by polarity reversal.

37255 **(AERE-R—10942) Use of ultrafiltration for the clean-up of alkaline Pu containing effluents.** Biddle, P.; Gutman, R.G. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Jul 1983. 23p. HMSO, London, price $4.00.

Ultrafiltration has been used to clean up low level Pu solutions at high pH. The decontamination factors achieved were greater than 1000 and were significantly higher than those attained by sedimentation or centrifugation. The results confirmed the findings of earlier work based on the use of Th as a simulant for Pu. A preliminary flowsheet for the decontamination of Pu oxalate liquors is proposed.

37256 **(ANL—83-88) Fuel Cycle Programs. Quarterly progress report, July-September 1983.** Steindler, M.J. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 188p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84015323.

Waste forms of nuclides separated from fuel reprocessing streams and their disposal have been evaluated in regard to compliance with regulations; the compliance analysis and suggestions for technological development and amendments to regulations are discussed. Experiments regarding the ability of swelling backfill materials to retard groundwater flow in a nuclear waste repository, and to retain that ability under the severe conditions expected, are described; they include dehydration and radiation effects and alteration by groundwater vapor. To evaluate the potential for dispersal of radioactivity from a nuclear waste repository, laboratory analog experiments combine backfill, radioactive waste, and rock in flowing groundwater in a manner analogous to a repository breach. The effect of organic matter in groundwater on mobilization of heavy metals is discussed; a task to analyze natural geothermal systems to understand the role of rock-water interactions in the movement of trace elements is just beginning. A test procedure to investigate the reaction of nuclear waste glass with water is being developed; the results are to provide licensing information for the Nevada Test Site repository. Destructive analyses of full-length irradiated fuel rods will be accomplished using equipment and systems now being installed, tested, and qualified. Included are a full-scale shear facility, dual dissolver system, and other facilities and system. In fusion reactor development, analysis of data from an experiment on tritium recovery is under way. The use of liquid metal as a breeder blanket or coolant is being reviewed. The most practical breeder concepts are a liquid breeder cooled by water or helium. A final report on tritium processing systems for mirror and tokamak fusion reactor designs is presented. 57 figures, 63 tables.

37257 **(ANL/EES-TM—243-Rev.) Radioactive waste isolation in salt: peer review of Office of Nuclear Waste Isolation's Socioeconomic Program Plan.** Winter, R.; Fenster, D.; O'Hare, M.; Zillman, D.; Harrison, W.; Tisue, M. (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 50p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84015223.

Includes 1 sheet of 24x reduction microfiche.

The following recommendations have been abstracted from the body of this report. The Office of Nuclear Waste Isolation's Socioeconomic Program Plan for the Establishment of Mined Geologic Repositories to Isolate Nuclear Waste should be modified to: (1) encourage active public participation in the decision-making processes leading to repository site selection; (2) clearly define mechanisms for incorporating the concerns of local residents, state and local governments, and other potentially interested parties into the early stages of the site selection process. In addition, the Office of Nuclear Waste Isolation should carefully review the overall role that these persons and groups, including local pressure groups organized in the face of potential repository development, will play in the siting process; (3) place significantly greater emphasis on using primary socioeconomic data during the site selection process, reversing the current overemphasis on secondary data collection, description of socioeconomic conditions at potential locations, and development of analytical methodologies; (4) include additional approaches to solving socioeconomic problems. For example, a reluctance to acknowledge that solutions to socioeconomic problems need to be found jointly with interested parties is evident in the plan; (5) recognize that mitigation mechanisms other than compensation and incentives may be effective; (6) as soon as potential sites are identified, the US Department of Energy (DOE) should begin discussing impact mitigation agreements with local officials and other interested parties; and (7) comply fully with the pertinent provisions of NWPA.

37258 **(ANL/EES-TM—256) Radioactive waste isolation in salt: special advisory report on the status of the Office of Nuclear Waste Isolation's plans for repository performance assessment.** Ditmars, J.D.; Walbridge, E.W.; Rote, D.M.; Harrison, W.; Herzenberg, C.L. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 149p. NTIS, PC E07/MF A01; GPO Dep. Order Number DE84014573.

Includes 5 sheets 24x reduction microfiche.

Repository performance assessment is analysis that identifies events and processes that might affect a repository system for isolation of radioactive waste, examines their effects on barriers to waste migration, and estimates the probabilities of their occurrence and their consequences. In 1983 Battelle Memorial Institute's Office of Nuclear Waste Isolation (ONWI) prepared two plans - one for performance assessment for a waste repository in salt and one for verification and validation of performance assessment technology. At the request of the US Department of Energy's Salt Repository Project Office (SRPO), Argonne National Laboratory reviewed those plans and prepared this report to advise SRPO of specific areas where ONWI's plans for performance assessment might be improved. This report presents a framework for repository performance assessment that clearly identifies the relationships among the disposal problems, the processes underlying the problems, the tools for assessment (computer codes), and the data. In particular, the relationships among important processes and 26 model codes available to ONWI are indicated. A common suggestion for computer code verification and validation is the need for specific and unambiguous documentation of the results of performance assessment activities. A major portion of this report consists of status summaries of 27 model codes indicated as potentially useful by ONWI. The code summaries focus on three main areas: (1) the code's purpose, capabilities, and limitations; (2) status of the elements of documentation and review essential for code verification and validation; and (3) proposed application of the code for performance assessment of salt repository systems. 15 references, 6 figures, 4 tables.

37259 **(BMI/OCRD—15) Synthesis of borehole geophysical data at the Underground Research Laboratory, Manitoba, Canada.** Keys, W.S. (Geological Survey, Denver, CO (USA)). Jul 1984. Contract AI02-83CH10143. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015470.

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A suite of borehole-geophysical logs, supported by core data, was used to describe the rock matrix and fractures in a granitic pluton near Lac du Bonnet, Manitoba, Canada. The site is being developed by Atomic Energy of Canada Limited, as an underground research laboratory to conduct geotechnical research and to validate predictive models as part of Canada's nuclear-fuel, waste-management program. However, the site is not planned to be used for waste disposal. Geophysical well logs were used to distinguish and correlate rock types and fractures between drill holes. Two significant fracture zones that are two of the major zones of groundwater movement at the site were identified by acoustic-televiewer logs. A new heat-pulse flowmeter provided repeatable measurements of very low-velocity, vertical flow in drill holes which enabled the identification of specific fractures that were transmitting water. Borehole gamma spectra showed that some fractures are enriched in uranium, and others may be depleted. This study demonstrates some of the advantages of synthesizing available borehole-geophysical logs at a site in fractured plutonic rocks and indicates how this information can contribute to an understanding of the geophysical conditions at the site.

37260 **(BMI/ONWI—9(83-4)) Management activities for DOE's National Waste Terminal Storage Program. Technical progress report for the quarter, 1 July-30 September 1983.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 81p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84015265.

This report describes the technical accomplishments during the period from July through September, 1983, on the commercial nuclear waste management programs under the direction of the U.S. Department of Energy (DOE), National Waste Terminal Storage Program Office (NPO), Office of Nuclear Waste Isolation (ONWI). The ONWI program is organized into the following eight tasks: (1) systems; (2) waste package; (3) site which covers generic data, Permian Basin data, Paradox Basin data, Gulf Coast salt dome basin data; (4) repository; (5) regulatory and institutional; (6) test facilities and excavations; (7) land; and (8) program management.

37261 **(BMI/ONWI—533) Assessment of the impacts of spent fuel disassembly alternatives on the Nuclear Waste Isolation System.** (Johnson (E.R.) Associates, Washington, DC (USA)). Jul 1984. Contract AC02-83CH10140;AC06-76RL01830. 320p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84015532.

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The objective of this report was to evaluate four possible alternative methods of preparing and packaging spent fuel assemblies for geologic disposal against the Reference Process of unmodified spent fuel. The four alternative processes were: (1) End fitting removal, (2) Fission gas venting and resealing, (3) Fuel bundle disassembly and close packing of fuel pins, and (4) Fuel shearing and immobilization. Systems analysis was used to develop a basis of comparison of the alternatives. Conceptual processes and facility layouts were devised for each of the alternatives, based on technology deemed feasible for the purpose. Assessments were made of 15 principal attributes from the technical, operational, safety/risk, and economic considerations related to each of the alternatives, including both the surface packaging and underground repository operations. Specific attributes of the alternative processes were evaluated by assigning a number for each that expressed its merit relative to the corresponding attribute of the Reference Process. Each alternative process was then ranked by summing the numbers for attributes in each of the four assessment areas and collectively. Fuel bundle disassembly and close packing of fuel pins was ranked the preferred method of disposal of spent fuel. 63 references, 46 figures, 46 tables.

37262 **(BMI/SRP—5020) Pumping test and fluid sampling report - Mansfield No. 1 (PD-4) well, Palo Duro Basin, Texas: unanalyzed data.** (Stone and Webster Engineering Corp., Boston, MA (USA)). Jul 1984. Contract AC06-76RL01830;AC02-83CH10140. 300p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84015300.

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This report contains pumping test and fluid sampling data collected at Mansfield No. 1 well, located in Oldham County, in the Permian Basin of Texas. These data were collected by Stone and Webster Engineering Corporation to support studies of fluid migration and age relationships in the Permian Basin. The testing and sampling took place between October 1981 and October 1982. These data are preliminary. They have been neither analyzed nor evaluated. 4 references, 8 figures, 2 tables.

37263 **(BMI/SRP—5023) Report of laboratory testing on rock core samples - Detten No. 1 (PD-6) well, Palo Duro Basin, Texas: unanalyzed data.** (Stone and Webster Engineering Corp., Boston, MA (USA)). Aug 1984. Contract AC02-83CH10140. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014826.

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This report contains laboratory test results for rock samples from Detten No. 1 Well of the Permian Basin. Laboratory test samples were measured for water content, density and effective porosity, Schmidt rebound hardness index, splitting tensile strength, slake durability index and Atterberg limits. Specimen descriptions listed in Appendix 1 include the depth to the top of the specimen, the formation and lithological description for each specimen. These data are preliminary. They have been neither analyzed nor evaluated.

37264 **(CONF-840627—8) Design improvements on shallow-land burial trenches for disposing of low-level radioactive waste.** Takamura, E.S.; Salsman, J.M. (Texas Univ., Austin (USA)). 1984. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014079.

From 29. annual meeting of the Health Physics Society; New Orleans, LA, USA (3 Jun 1984).

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The lack of success of closed low-level radioactive waste disposal sites has prompted the federal government to increase regulation of these facilities. In order to meet these increased requirements, several waste trench improvements are necessary. These improvements to the trench include sandy-clay caps, compacted sandy-clay bottoms, in-place geophysical instruments and vadose zone sampling equipment, and concrete sidewalls. These design improvements presented in this paper should increase the containment of the radionuclides by decreasing the waste contact with infiltrating groundwater. The design improves on the monitoring and sampling methods for detecting radionuclides transported through the leachate or gas effluent streams. 13 references, 4 figures.

37265 **(CONF-8406142—4) Disposal of waste by hydraulic fracturing.** Tamura, T.; Weeren, H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014052.

From Hazardous materials management conference; Philadelphia, PA, USA (5 Jun 1984).

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Liquid radioactive waste solutions at the Oak Ridge National Laboratory (ORNL) have been disposed of for nearly 20 years by preparing a slurry, injecting it into bedding plane fractures formed in low-permeability shale, and allowing the slurry to set into a solid. Three major considerations are required for this method: a rock formation that forms horizontal or bedding plane fractures and is highly impermeable, a plant facility that can develop sufficient hydraulic pressure to fracture the rock and to inject the slurry, and a slurry that can be pumped into the fracture and that will set, preferably, into a low-leaching solid. The requirements and desirable conditions of the formation, the process and facility as used for radioactive waste disposal, and the mix formulation and slurry properties that were required for injection and solidification are described. The intent of this paper is to stimulate interest in this technique for possible application to nonnuclear wastes.

37266 **(DOE/ER/45013—2) Crystal chemistry of portland cement hydrates as radioactive waste hosts. Final report, June 15, 1983-June 14, 1984.** Grutzeck, M.W.; Brown, D.; Hoyle, S. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). 14 Jun 1984. Contract AC02-83ER45013. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015112.

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Portland cement hydrates have been used as encapsulant/host phases in radioactive waste management. However, their phase chemistry and stability relationships are poorly defined. Therefore, on occasion, they have not performed as well as expected. As a result, their use has been mainly limited to low-level waste disposal. Since this knowledge gap existed, we had begun to investigate the crystal chemistry of the portland cement hydrates. It was our objective to identify potential hydrate host phases which were not only suitable for isolating radioactive-waste species but also inexpensive, easily processed, low-temperature materials. Initially, we were concentrating upon two areas of interest: the fixation of iodine by the calcium aluminate hydrates and the feasibility of using Stratling's compound as a host phase for cesium and strontium fixation. In both cases, a phase equilibrium study was initiated in order to identify phase relations and consequences of adding the species of interest to the system. An iodine-containing analogue of calcium monosulfoaluminate hydrate ($C_3A.CaI_2.xH_2O$) was identified as a possible host phase. CsOH was added to formulations in the neigh-

borhood of Stratling's compound, in order to establish phase relations and identify the fixation ability of Stratling's compound and its associated hydrates. 11 figures, 9 tables.

37267 **(DOE/ID/01570—T63) Managing low-level radioactive waste in Massachusetts. Final report.** Bander, S.R.; Goldstein, M.E. (Massachusetts Dept. of Public Health, Boston (USA). Low-Level Waste Project Staff). Dec 1983. Contract AC07-76ID01570. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84011570.

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As one of the country's largest generators of low-level radioactive waste, Massachusetts has begun independently seeking solutions to the questions surrounding low-level waste management issues. The Massachusetts Department of Public Health, Radiation Control Program, obtained funding from the U.S. Department ofEnergy through EG and G, Idaho, Inc. to develop a low-level waste management strategy for the Commonwealth. The Working Group was made up of individuals from various waste generating industries, environmental and public interest groups, medical and academic institutions, and affected state agencies. This final report document contains the following staff project reports: Proposed Low-Level Radioactive Waste Management Plan for The Commonwealth of Massachusetts, February 1983 and Low-Level Radioactive Waste Management in Massachusetts - Actions to be Considered for Implementation in 1984-1986, December 1983. These two staff reports represent the completion of the Massachusetts Low-Level Radioactive Waste Management Project. The first report provides some of the background material to the issues and some of the alternative courses of action which can be considered by state policy-makers. The second report provides the next phase in the process by delineating specific steps which may be taken before 1986 in order to address the low-level waste problem, and the estimated amount of time needed to complete each step.

37268 **(DOE/LLW—18T-Rev.4) Radioactive waste management: a summary of state laws and adminstration. Revision 4.** (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1984. Contract AC07-76ID01570. 553p. NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE84014552.

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This is the fourth update of Radioactive Waste Management: a summary of State Laws and Administration. It completely replaces the third update (January 15, 1984). The updated report covers the administration, the legislature and the laws in the 50 states related to radioactive waste. The report for each state is divided into four sections: cover page; administrative; legislative; and applicable legislation. In general, the information in this report is accurate as of April 30, 1984.

37269 **(DOE/NE—SH01) Uranium mill tailings remedial action program. Radiological survey of Shiprock vicinity property SH01, Shiprock, NM, August-November 1982.** Flynn, K.F.; Justus, A.L.; Sholeen, C.M.; Smith, W.H.; Wynveen, R.A. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 74p. (ANL-OHS/HP—84-SH01). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014829.

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A comprehensive survey of the vicinity property designated as SH01 was conducted on an intermittent basis from August 23 to November 11, 1982. At the time of the survey, three structures were located on the property - two residential structures and a residential trailer. In addition to the three residences, the frame from a former truck scale was still on the property. The lands surrounding the structures and former truck scale were sparsely covered with vegetation. The assessment activities included determination of indoor and outdoor surface radiation levels through direct instrument surveys and analysis of air and soil samples. No evidence of radioactive contamination was found inside the structures, although elevated levels of radioactivity due to proximity to or shine from contaminated soils were indicated within all. The short-term radon daughter measurements did not exceed the limit of 0.02 Working Level for average annual concentration including background, as specified in the EPA Standard 40 CFR 192. The assessment indicated elevated levels of radioactivity in the outdoor environs, encompassing about 32,000 ft^2 (2900 m^2) of land surrounding, and north of, the former truck scale. Analysis of a surface soil sample collected from the environs indicated a radium concentration considerably in excess of the limit of 5 pCi/g above background specified in the EPA Standard. Subsurface soil sampling was not conducted, and thus the vertical extent of the radiological contamination is not known. Since the surface soil contamination level exceeded the limit specified in the EPA Standard, remedial action for this vicinity site should be considered.

37270 **(DOE/NE—SH03) Uranium mill tailings remedial action program. Radiological survey of Shiprock vicinity property SH03, Shiprock, NM, July-November 1982.** Flynn, K.F.; Justus, A.L.; Sholeen, C.M.; Smith, W.H.; Wynveen, R.A. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 80p. (ANL-OHS/HP—84-SH03). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014841.

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A comprehensive survey of the vicinity property designated as SH03 was conducted on an intermittent basis from July 26 to November 11, 1982. At the time of the survey, three structures were located on the property - a residential trailer, the main structure, and an old gas pump housing. The lands surrounding the structures were either sparsely covered with arid vegetation or paved. The assessment activities included determination of indoor and outdoor surface radiation levels, for both fixed and removable contamination, through direct instrument and smear (indoor only) surveys; measurement of ambient external penetrating radiation levels at 1-meter heights; and analyses of air, soil, and other material samples. No evidence of radioactive contamination was found inside the trailer. However, the results of the radiological assessment did indicate the occurrence of elevated levels of gamma, surface alpha, and radon daughter radioactivity within the main structure. The short-term radon daughter measurements exceeded the limit of 0.02 Working Level for average annual concentration including background. The assessment also indicated elevated levels of radioactivity in the outdoor environs, encompassing about 32,000 ft^2 of the grounds adjacent to and surrounding the main structure on the east, south, and west sides. The contamination appeared to be due to the presence of unprocessed uranium ore. Analysis of surface soil samples collected from the environs indicated radium concentrations in excess of the limit of 5 pCi/g above background specified in the EPA Standard. Subsurface soil sampling was not conducted, and thus the vertical extent of the radiological contamination is not known. Since the surface soil contamination levels exceeded the limits specified in the EPA Standard, remedial action for this vicinity site should be considered.

37271 **(DOE/NE—SH12) Uranium mill tailings remedial action program. Radiological survey of Shiprock vicinity property SH12, Shiprock, NM, October-November 1982.** Flynn, K.F.; Justus, A.L.; Sholeen, C.M.; Smith, W.H.; Wynveen, R.A. (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 81p. (ANL-OHS/HP—84-SH12). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014782.

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A comprehensive survey of the vicinity property designated as SH12 was conducted on an intermittent basis from October 27 to November 22, 1982. At the time of the survey, several exhibition halls and concession stands; an auction yard; a race track and rodeo arena with associated stands, shutes, and corrals; and a hogan were located on the property. The surrounding environs were either sparsely covered with arid vegetation or covered with gravel. The assessment activities included determination of indoor and outdoor surface radiation levels, for both fixed and removable contamination, through direct instrument and smear (indoor only) surveys; measurement of ambient external penetrating radiation levels at 1-meter heights; and analyses of air, soil, and other material samples. The radiological assessment indicated elevated levels of radioactivity within only one of the structures. Background levels of radioactivity were indicated within all other structures. The assessment in-

dicated elevated levels of radioactivity at the rodeo arena and nearby shutes and corrals, encompassing about 49,000 ft² of land. Radiochemical analysis of the soil sample collected from this general area indicated 23 +- 2 pCi/g for radium, which is in excess of the limit of 5 pCi/g above background, averaged over the first 15 cm of soil below the surface. Elevated levels of radioactivity were also found at the southern end of the west parking lot, encompassing about 7500 ft² of land, and at several areas in the southern section of the property, encompassing about 160,000 ft² of land. Radiochemical analyses of two of the soil samples collected from the southern section indicated radium concentrations of 43 +- 5 and 42 +- 5 pCi/g of soil, in excess of the limit of 5 pCi/g above background as specified in the EPA Standard. Subsurface soil sampling was not conducted, and thus the vertical extent of the radiological contamination is not known.

37272 **(DOE/OR/20722—4) Radiological survey of the former Shpack Landfill, Norton, Massachusetts.** (Bechtel National, Inc., Oak Ridge, TN (USA)). May 1984. Contract AC05-81OR20722. 166p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84012082.

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The distribution of contamination on the Shpack Landfill site is spotty and uneven, both horizontally and vertically. Although some hotspots exceed the Formerly Utilized Sites Remedial Action Program (FUSRAP) criteria (see Appendix B), average concentrations of soil contamination are below the residual limits requiring remedial action. Removal of the hotspots only would generate approximately 390 m³ (400 yd³) of low-level radioactive waste. However, because of the relative physical and chemical stability of the radioactive contamination, such an effort could be deferred without harmful effect to individuals, the public or the natural environment. The site is also widely contaminated with chemical pollutants that might eventually require remedial action pursuant to several state and federal environmental statutes. The timing and nature of these possible environmental improvements could easily negate the need for a separate remedial action to clean up the radioactive contamination.

37273 **(DOE/OR/20722—8) Niagara Falls Storage Site, Lewiston, New York: geologic report.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Jun 1984. Contract AC05-81OR20722. 410p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84013459.

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This report is one of a series of engineering and environmental reports planned for the US Department of Energy's properties at Niagara Falls, New York. It describes the essential geologic features of the Niagara Falls Storage Site. It is not intended to be a definitive statement of the engineering methods and designs required to obtain desired performance features for any permanent waste disposal at the site. Results are presented of a geological investigation that consisted of two phases. Phase 1 occurred during July 1982 and included geologic mapping, geophysical surveys, and a limited drilling program in the vicinity of the R-10 Dike, planned for interim storage of radioactive materials. Phase 2, initiated in December 1982, included excavation of test pits, geophysical surveys, drilling, observation well installation, and field permeability testing in the South Dike Area, the Northern Disposal Area, and the K-65 Tower Area.

37274 **(DOE/RW—0005-Draft-Vol.1-2) Mission Plan for the Civilian Radioactive Waste Management Program. Volumes I and II. Overview and current program plans.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Apr 1984. 410p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84015282.

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The Nuclear Waste Policy Act of 1982, signed by the President on January 7, 1983, requires the Secretary of Energy to prepare a comprehensive report known as the Mission Plan. The purpose of this report, as stated in Section 301.(a) of the Act, is to provide an informational basis sufficient to permit informed decisions to be made in carrying out the repository program and the research, development, and demonstration programs required under this Act. Section 301.(b) of the Act further requires the Secretary to submit a draft of the Mission Plan, for comment, to the States, affected Indian tribes, Nuclear Regulatory Commission, and other Government agencies prior to submitting the Mission Plan to the Congress. Volume I of the draft Mission Plan begins with a brief introduction listing the program's major objectives and discussion of the overall program strategy. It continues with a detailed discussion of program plans and the intended schedule for mined geologic repositories, monitored retrievable storage, transportation, and Federal interim storage. Volume I concludes with a discussion of program management. Volume II presents the detailed information required by Section 301.(a) of the Act - key issues and information needs; plans for obtaining the necessary information; plans for the test and evaluation facility; financial, institutional, and legal issues; principal results obtained to date from site investigations; information on the exploratory shaft; information on the waste package; schedules; cost; and socioeconomic impacts. 76 references, 54 figures, 16 tables.

37275 **(DP—81-125-4) Waste Management Program. Technical progress report, October-December 1981.** Stevens, W.R. III. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1984. Contract AC09-76SR00001. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84015899.

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This quarterly report provides current information on operations and development programs for the management of radioactive wastes from operation of the Savannah River Plant. The studies on environmental and safety assessments, other support, separation and concentration, waste form development and characterization, and process and equipment development are a part of the Long-Term Waste Management Technology Program. The following studies are reported for the SR Interim Waste Operations Program: surveillance and maintenance, waste concentration, low-level effluent waste, waste tank evaluation, tank replacement/waste transfer, and solid waste storage and related activities. 24 references, 32 figures, 36 tables.

37276 **(DP—82-125-2) Waste Management Program. Technical progress report, April-June, 1982.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1984. Contract AC09-76SR00001. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015066.

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This quarterly report provides current information on operations and development programs for the management of radioactive wastes from operation of the Savannah River Plant. The studies on environmental and safety assessments, process and equipment development, transuranic waste management, low-level waste management, airborne waste management, and Defense Waste Processing Facility are a part of the Long-Term Waste Management Technology Program. The following studies are reported for the SR Interim Waste Operations Programs: surveillance and maintenance, waste concentration, low-level effluent waste, tank replacement/waste transfer, process development, and solid waste storage and related activities. 133 references.

37277 **(DP-MS—83-125) DWPF remotable television and cell lighting facilities.** Heckendorn, F.M. II. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 5p. (CONF-840614—76). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013962.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

The Defense Waste Processing Facility (DWPF) for radioactive waste vitrification at the Savannah River Plant (SRP) is now under construction. Development of specialized low cost television (TV) viewing equipment for in-cell and within-melter applications is now complete. High resolution TV cameras not originally designed for high radiation environments have been demonstrated in

crane remotable packages to be well suited to the DWPF. High intensity in-cell lighting has also been demonstrated in crane remotable assemblies. These dual 1000 W units (2000 W total) are used to support the multiplicity of TV and cell window viewing requirements. 8 figures.

37278 **(DP-MS—83-133) Leaching radioactive and nonradioactive elements from actual Savannah River Plant nuclear waste glass.** Bibler, N.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 12p. (CONF-840440—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013957.

From 86. annual meeting and exposition of the American Ceramic Society; Pittsburgh, PA, USA (29 Apr 1984).

Glass containing actual SRP radioactive waste and glass containing nonradioactive simulated waste leach similarly. Radioactivity is not significantly affecting the leaching process by irradiating the glass or the deionized water leachate. Tests with simulated groundwaters are in progress. 5 references, 5 figures, 2 tables.

37279 **(DPST—84-494) Precipitation Test Facility. Run 2 and Run 3.** Schmitz, M.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 14 Apr 1982. Contract AC09-76SR00001. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014977.

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The Precipitation Test Facility (PTF) is the first large scale-up of the Precipitation Salt Decontamination Process developed by Lien Lee and Lester Kilpatrick of CTD. The PTF was designed to provide basic data related to the general operability of the process and effects of process variables. PTF Run 2 and PTF Run 3 were designed to demonstrate the process and to improve overall filtrate rates. PTF Run 2 used a centrifugal feed pump to transfer potassium/cesium tetraphenylborate slurries through cross-flow filters. Filtrate rates ranged from 0.02 to 0.10 gpm/ft^2 of filter area depending on slurry feed rate, slurry concentration, filtrate pressure differential, backpulsing, and operating time. PTF Run 3 was designed to examine the same variables using a low-shear diaphragm feed pump for slurry transfer. Filtrate rates improved significantly, ranging from 0.14 to 0.35 gpm/ft^2 of filter area. Optimum conditions were achieved at a slurry feed rate of 3 ft/s, a backpulse interval of 5 minutes and a filtrate differential pressure below 40 psi. 7 figures, 1 table.

37280 **(EGG-MS—6614) Corrosion studies on PREPP waste form.** Welch, J.M.; Neilson, R.M. Jr. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1984. Contract AC07-76ID01570. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015169.

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Deformation or Failure Test and Accelerated Corrosion Test procedures were conducted to investigate the effect of formulation variables on the corrosion of oversize waste in Process Experimental Pilot Plant (PREPP) concrete waste forms. The Deformation or Failure Test did not indicate substantial waste form swelling from corrosion. The presence or absence of corrosion inhibitor was the most significant factor relative to measured half-cell potentials identified in the Accelerated Corrosion Test. However, corrosion inhibitor was determined to be only marginally beneficial. While this study produced no evidence that corrosion is of sufficient magnitude to produce serious degradation of PREPP waste forms, the need for corrosion rate testing is suggested. 11 references, 4 figures, 8 tables.

37281 **(EIR—409) Anhydrite as a possible host rock for the storage of radioactive waste.** Mueller, W.H.; Briegel, U.; Baumann, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Aug 1980. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701521.

Investigations on the possibility of using anhydrite to store radioactive wastes are described. The report contains a rheological and a microstructural study of anhydrite.

37282 **(EIR—480) Quality control of solidified intermediate and highly active wastes.** Zwicky, H.U.; Bart, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jan 1983. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701614.

It is shown that quality control on processed radioactive waste (for temporary storage) is an important component in an extensive waste-quality safety program. The quality controls should follow the following steps: determination of container dimensions and weight; determination of surface contamination; calorimetry for measurement of heat production of highly active waste; determination of gamma flux and temperature distribution on the container surface; and neutron measurement for calculating the transuranic elements content. The various methods are presented and discussed. A possible control system in an intermediate layer is presented.

37283 **(EPRI-NP—3577) Low-level radwaste engineering economics.** Jacobs, M.H.; Miller, C.C.; Young, L.G. (Sargent and Lundy, Chicago, IL (USA)). Jul 1984. 222p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920441.

This topical report on engineering economics for low-level radwaste systems details the methodologies used for economic analyses of radwaste treatment systems and provides examples of radwaste economic evaluations. All of the parameters and cost items used in an evaluation are defined. Examples of the present-value-of-revenue-requirements method, levelized-revenue-requirements method, and the equivalent-capital-investment method are provided. Also, the calculation to determine the maximum justifiable capital expenditure for a radwaste system is illustrated. The report also provides examples of economic evaluations for many current radwaste treatment options. These options include evaporation versus demineralization, dewatering resins versus solidification of resins, and several volume reduction systems. 15 figures, 6 tables.

37284 **(EPRI-NP—3617) On-site storage of low-level radwaste: a survey. Final report.** Rutland, L.; Papaiya, N.C. (Burns and Roe, Inc., Oradell, NJ (USA)). Jul 1984. 119p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920472.

Low-level radwaste disposal for years has been characterized by rapidly increasing disposal costs and reduction in the availability of commercial disposal facility space. Many nuclear utilities have responded to this situation by at least considering augmenting radwaste volume reduction systems and on-site storage facilities. A survey was performed under EPRI sponsorship to contact nuclear power utilities to detail their actions and plans as regards radwaste volume reduction and on-site storage. This information was analyzed to include the influence of site specific and regional factors on the utilities individual responses. This report summarizes the survey findings, and presents facility drawings that characterize typical nuclear utility actions and planning. This information should assist nuclear power utilities that will commence similar planning.

37285 **(EUR—7374) Low and medium activity solid wastes processing and encapsulation.** Taillard, D.; Claes, J.; Hennart, D. (Commission of the European Communities, Luxembourg). 1983. 295p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84701615.

This work, carried out under contract with the European Atomic Energy Community, describes the techniques in use for waste management. The activity of low and medium activity solid wastes is from few curies to few tens of curies per cubic meter, they are produced by nuclear facilities and are often complex mixtures. Radioactive wastes are characterized and processing and conditioning are described. Leaching, stability, mechanical resistance and radiolysis of encapsulated wastes are examined. Handling, storage and disposal are treated.

37286 **(EUR—7620(Vol.1)) General conceptual design study for a high level radioactive waste repository in a granite formation. Volume 1.** (Commission of the European Communities, Luxembourg). 1982. 656p. NTIS (US Sales Only), PC A99/MF A01. Order Number DE84701618.

The object of the general conceptual design study for a repository for disposal of radioactive waste in a granite formation is to ensure that the technology available in 1980 is suitable for the construction of such a repository. The recommended techniques and equipment are suitable for construction of a repository, located at a depth of 1000 metres in a granite batholith, with a capacity of 30,000 AVM canisters, cooled for 30 years on the surface, at a rate of 1,000 canisters per year. The structure consists of six access shafts of 4 and 5 metres diameter, drilled from the surface by the big-hole method, serving a network of 82 parallel galleries, 2,300 metres long, mined by conventional blasting. Shafts 100 metres deep are drilled in the floor of each gallery (74 shafts per gallery), each shaft accommodating five canisters. This represents an aggregate gallery length of 200 kilometres and an aggregate shaft length of 600 kilometres. The cost of the operation is 1.3% of the cost (ex-works) of the energy produced by the power stations generating the waste. Construction, operation and final abandonment will take 81 years. The sensitivity study of the design showed, by varying certain parameters, that location of the repository at a depth of 500 metres is not recommended and that the area covered by the repository of 4 km^2 is halved if the canisters are first cooled for 100 years.

37287 **(EUR—7620(Vol.2)) General conceptual design study for a high-level radioactive waste repository in a granite formation. Figures and drawings.** (Commission of the European Communities, Luxembourg). 1982. 176p. (In French, English). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701619.

The object of the general conceptual design study for a high level radioactive wastes repository in a deep lying granite formation is to ensure that technology available in 1980 is suitable for building, operating and finally closing such a repository. It is feasible to build and operate a 1000 m deep repository, located in a granite batholith, receiving 30000 AVM canisters (after 30 years surface cooling), the disposal rate being 1000 canisters per year. Cost of the operation amounts to 1,3% of the corresponding amount of electricity. The building, operating and final closing phases will take 81 years.

37288 **(EUR—8178) Study of the possibilities of radioactive waste storage in crystalline formations. Investigation by deep drilling of the Auriat granite.** (Commission of the European Communities, Luxembourg). 1982. 20p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701620.

Various and complex scientific problems are raised in many areas by the disposal of radioactive waste in geological formations. Research works are therefore numerous, and are carried out in four basic areas: improvement of the knowledge of geological media; characterization of their behaviour vis a vis radioactive waste; design of deep repositories; long-term safety assessment of the selected disposal strategies. Aim of the present research is to develop a methodology for investigating granite formations at great depth, in order to characterize their internal structure, and to acquire data about the various physical properties of granite. This research therefore covers the first basic aspect. These goals were obtained by continuous core-drilling of two vertical boreholes at 10m pitch. The main borehole was drilled down to 1003.15 m deep, the second one was stopped at 504.40 m deep.

37289 **(EUR—8574) Management and disposal of alpha-contaminated wastes. A survey of current practices, strategies and R and D activities in some EC countries and the USA.** Mannone, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. 141p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84701621.

In view of the rationalization of radwaste treatment, conditioning and storage procedures so far applied at the Ispra Establishment, a survey of alpha-waste management practices and strategies currently in use or under development in some EC countries and in the USA has been carried out. In considering radwastes arising at nuclear research centres and nuclear plants, the most importance has been attached here to their alpha- rather than to their beta- or gamma-contamination degree. Various process technologiques currently practised for pre-treatment, conditioning, storage and/or disposal of alpha-waste at several European nuclear centres and plants, as well as at some US DOE laboratories, have been scrutinized, including also process operations aimed at recovering Pu, both for economical and ecological reasons. The present alpha-waste management and disposal scenario has been completed by the survey of research, development and demonstration work underway in Europe and in the USA in this field. Finally, national organizations, policies and strategies for radwastes management and disposal have been briefly outlined. As main source of information, the proceeding of several technical seminars, symposia, meetings and conferences, individually and jointly organized by the NEA (OECD), IAEA, CEC and published during about the last 20 years have been utilized. This report is intended to give the necessary background for the critical review of waste management practices so far applied at the Ispra Establisment, as well as for their possible modifications according to more up-to-date management schemes.

37290 **(EUR—8663) Characterization of low and medium level radioactive waste forms.** Sambell, R.A.J. (Commission of the European Communities, Luxembourg). 1983. 118p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84701617.

The work reported was carried out during the first year of the Commission of the European Community's programme on the characterization of low and medium level waste forms. Ten reference waste forms plus others of special national interest have been identified covering PWR, BWR, GCR and reprocessing wastes. The immobilising media include the three main matrices: cement, polymers and bitumen, and a glass. Characterization is viewed as one input to quality assurance of the waste form and covers: waste-matrix compatibility, radiation effects, leaching, microbiological attack, shrinkage and swelling, ageing processes and thermal effects. The aim is a balanced programme of comparative data, predictive modelling and an understanding of basic mechanisms.

37291 **(EUR—8747) Development of a geophysical methodology from boreholes for the study of granitic formation storage site.** Le Masne, D. (Commission of the European Communities, Luxembourg). 1983. 148p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84701622.

The aim of this work is the characterization of the fracturation of a granitic formation by the examination of borehole environment. Two types of methods are used. Methods using one borehole only: well logging (electrical and nuclear). Didier logs (electric dipole-dipole), Eric probes (electromagnetic dipole-dipole) and methods between boreholes (grounding). These methods were applied to two boreholes of 500m and 1000 meters drilled into granite at Auriat (France).

37292 **(GA-A—17634) Test results from the GA technologies engineering-scale off-gas treatment system.** Jensen, D.D.; Olguin, L.J.; Wilbourn, R.G. (GA Technologies, Inc., San Diego, CA (USA)). Jun 1984. Contract AT03-84SF11964. 11p. (CONF-840806—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014693.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

One method for reducing the volume of HTGR fuel prior to reprocessing or spent fuel storage is to crush and burn the graphite fuel elements. The burner off-gas (BOG) contains radioactive components, principally H-3, C-14, Kr-85, I-129, and Rn-220, as well as chemical forms such as CO_2, CO, O_2, and SO_2. The BOG system employs components designed to remove these constitutents. Test results are reported for the iodine and SO_2 adsorbers and the CO/HT oxidizer. Silver-based iodine adsorbents were found to catalyze the premature conversion of CO to CO_2. Subsequent tests showed that iodine removal could not be performed downstream of the CO/HT oxidizer since iodine in the BOG system rapidly deactivated the Pt-coated alumina CO catalyst. Lead-exchanged zeolite

(PbX) was found to be an acceptable alternative for removing iodine from BOG without CO conversion. Intermittent and steady-state tests of the pilot-plant SO_2 removal unit containing sodium-exchanged zeolite (NaX) demonstrated that decontamination factors $\geqq$ 100 could be maintained for up to 50 h. In a reprocessing flowsheet, the solid product from the burners is dissolved in nitric or Thorex acid. The dissolver off-gas (DOG) contains radioactive components H-3, Kr-85, I-129, Rn-220 plus chemical forms such as nitrogen oxides (NO/sub x/). In the pilot-scale system at GA, iodine is removed from the DOG by adsorption. Tests of iodine removal have been conducted using either silver-exchanged mordenite (AgZ) or $AgNO_3$-impregnated silica gel (AC-6120). Although each sorbent performed well in the presence of NO/sub x/, the silica gel adsorbent proved more efficient in silver utilization and, thus, more cost effective.

37293 (GSCan-P—82-1A, pp 247-259) **Mode of occurrence of secondary radionuclide-bearing minerals in natural argillized rocks. A preliminary report related to a barrier clay in nuclear waste disposal.** Rimsaite, J. 1982. NTIS (US Sales Only), PC A20/MF A01. Order Number DE84780154.

In Current research. Part A.

Three processes that may be activated by the emplacement of radionuclide-bearing waste in natural argillized rock are described: 1. natural decomposition of rock-forming and associated radioactive ore and accessory minerals, such as uraninite, uranothorite, allanite, pyrochlore, apatite, monazite, xenotime, tourmaline, zircon, sulphides and carbonates; 2. mobilization, migration and redeposition of U, Th, REE, Zr, radiogenic lead and other elements along fractures; 3. neoformation of autunite, torbernite, phosphuranylite, coffinite, boltwoodite, kasolite, uranophane, bayleyite, ruthefordine, liebigite, masuyite, anglesite, wulfenite and complex unidentified U, Th, Pb, REE and Zr compounds in clays and in fractures of hydrated rock-forming minerals. The mobilized radionuclides can be fixed by several processes, namely by adsorption, by reacting with other ions, and by entering and capture in the interlayer of swelling mixed-layer clays and hydrated layer silicates. These observations on the natural behaviour of radioactive and radiogenic materials can be applied in evaluating rock formations and planning preventive measures for the escape of nuclear waste from disposal sites.

37294 (IEAL-R—84-24-Vol.1) **Assessment of national systems for obtaining local siting acceptance of nuclear waste management facilities. Volume I. Background on the political structure and formal system for approving waste management siting decisions.** Paige, H.W.; Owens, J.E. (International Energy Associates Ltd., Washington, DC (USA)). 1 Apr 1983. Contract AC01-83DP30222;AC06-76RL01830. 99p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84015329.

This report is the third in a series of periodic surveys of approaches and progress in other countries in dealing with the problems of obtaining local acceptance for siting of waste management facilities. The following 15 countries are covered: Austria, Belgium, Canada, Denmark, Federal Republic of Germany, Finland, France, Italy, Japan, Mexico, Netherlands, Spain, Sweden, Switzerland, and United Kingdom. Volume I contains the following sections: nation's political/industrial structure for obtaining waste management siting decisions; and nation's formal legal procedure for obtaining necessary approvals for siting nuclear waste management facilities.

37295 (IEAL-R—84-24-Vol.2) **Assessment of national systems for obtaining local siting acceptance of nuclear waste management facilities. Volume II. Summary of principal new developments relating to the siting of waste management facilities.** Paige, H.W.; Owens, J.E. (International Energy Associates Ltd., Washington, DC (USA)). 1 Apr 1983. Contract AC01-83DP30222;AC06-76RL01830. 86p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84014773.

This report is the third in a series of periodic surveys of approaches and progress in other countries in dealing with the problems of obtaining local acceptance for siting of waste management facilities. The following 15 countries are covered: Austria, Belgium, Canada, Denmark, Federal Republic of Germany, Finland, France, Italy, Japan, Mexico, Netherlands, Spain, Sweden, Switzerland, and United Kingdom. Volume II contains information on the principal new developments and is divided, as applicable, into the following sections: status of nation's nuclear power program, including current government's policies regarding nuclear power in general and waste management in particular; status and plans regarding nation's waste management programs including activities of organizations responsible for management of nation's nuclear waste; status of nuclear waste management siting decisions; nonstatutory approaches used (informal system) to supplement the formal/legal system for obtaining approvals for siting of waste management facilities; and observations/conclusions.

37296 (INIS-mf—8731) **Cost-benefit analyses for the retention of tritium, carbon 14 and krypton 85 from plants reprocessing LWR fuel elements.** Gruendler, D. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 4 Jun 1981. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780261.

ICRP's new system for the limitation of permissible doses is applied for the determination of optimum emission rates from reprocessing plants. Equivalent doses and collective doses are calculated using radioecological methods. Economy-oriented and sociological methods were used to estimate the damage to health and life expressed in monetary units (α-value equals DM 200.-/manxrem). A cost-benefit analysis was done considering retention cost, collective doses and α-value, and the results were different from those supplied by the nowdays customary retention criteria, the latter being based on the limitation of individual doses rather than collective doses. The results are surprising because for the Gorleben facility retention of krypton-85 and tritium is planned, C-14 being left out of consideration so far. (DG).

37297 (INIS-mf—8936, pp 13-49) **Geological and material investigation programme.** Joshi, A.V. (ELSAM, Fredericia, Denmark). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The radioactive waste disposal problem is an interdisciplinary problem. The geological formation cannot be considered on its own, but must also be considered in connection with the engineering design of the disposal facility. Engineering design including the encapsulation of the glass in a 15-cm-thick steel cylinder and a minimum 40 year cooling time ensures low temperatures in the salt-steel interface. Even if large quantities of carnallite were found 3.5 m away from the sides of the borehole, the temperature at 2500 m depth after taking into account temperature increase from radioactive waste will not release crystal water from the carnallite. Anhydrite layers, which may be found in the neighbourhood of Erslev 2 and at the depths contemplated for radioactive waste disposal, will not be continous, but only in the form of blocks of limited lengths. They cannot therefore form a passage to a water bearing aquifer. The volume of salt necessary for waste disposal - including a 200 m safety barrier - is less than 2 km^3. The Mors dome with a salt volume of about 264 km^3 provides a very substantial safety margin. The geological investigations have fulfilled the purpose of the present phase of investigations and show the Mors salt dome to be a suitable dome for disposal of high-level radioactive waste. (EG).

37298 (INIS-mf—8936, pp 50-73) **Interior structures of salt domes.** Richter-Bernburg, G. Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

According to the investigations by geophysical measurements the trunk of the diapir has to be supposed close to the well Erslev 2 or the area near Groenholm. There, we should expect the occurrence of the oldest members of the Zechstein salt formation. Because that is the Z1 salt, which seems to be several hundred meters thick, and because the Z2 halite has also a thickness of some

hundred metres - whereas the carbonatic-anhydrite Passage Beds in between are scarcely to mention - we can beleive that an originally about 1000-m-thick salt mass is present there. In the salt-geological view, this area of the MORS SALT DOME promises to be very favourable for a depository project. (EG).

37299 (INIS-mf—8936, pp 74-98) **Seismic evaluation of the Mors Dome.** Kreitz, E. (PRAKLA-SEISMOS GMBH). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The "Seismic Case History" of the Mors salt dome was already published in detail by ELSAM/ELKRAFT so only a few important points need to be mentioned here: (a) Processing and interpretation of the seismic material. (b) Stratigraphic classification of the most important seismic reflection horizons. (c) Construction of the depth sections and description of the salt dome model. (d) Investigations of the problematic salt overhang using interactive seismic modelling. (EG).

37300 (INIS-mf—8936, pp 99-119) **Technical performance of drilling operations of wells Erslev 1 and 2 on Mors Salt Dome.** Gomm, H. (Kavernen Bau- und Betriebs GmbH). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

This paper deals strictly with the performance of the drilling itself. The wells were designed and drilled by an international team of experts, using a Cabot Franks Explorer 900 rig. The two exploration wells were located in the top area of the Mors Saltdome after geological and geophysical investigations at a distance of about 1 100 m. (EG).

37301 (INIS-mf—8936, pp 120-150) **Interpretation of the salt sections in wells Erslev 1 and 2 based on lithology and wireline logs.** Borger, K. (Kavernen Bau- and Betriebs GmbH). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

During the drilling operations, the well site geologists have collected the following geological and technical information required to enlighten the substructure of the salt dome below these two well sites: cuttings; rate of penetration; gas indications; cores. Mud loggers have taken-time lagged samples in 2.5 m intervals for lithological description; additional sets of cuttings have been collected at drilling breaks and/or changes of lithology. Rate of penetration has been recorded as well as gas indications. (EG).

37302 (INIS-mf—8936, pp 151-174) **Material investigations on salt.** Hoejgaard, K.E. (ELSAM, Fredericia, Denmark). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Results of exploratory boreholes in the Danish salt deposits at Mors (called "Erslev 1 and 2') are presented in form of diagrams and tables. Mineralogical, rock-mechnical and thermal investigations are summarized. (EG).

37303 (INIS-mf—8936, pp 175-195) **High-frequency electromagnetic reflection measurements in boreholes in the Mors and Vejrum salt dome.** Hofrichter, E.; Thierbach, R. (Niedersaechsisches Landesamt fuer Bodenforschung, Hannover); Sender, F.; Weichart, H. (Prakla-Seismos GmbH, Hannover). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Generally, the EMR-method works on the same principle as the wellknown radar. A pulsed signal of high frequency electromagnetic waves is emitted by the transmitting antenna, travels through the medium and is reflected at a discontinuity of conductivity or permittivity. It then travels back through the medium to the receiving antenna. The borehole must be filled with a non-conductive fluid such as oil. The data are stored in a computer memory and on magnetic tape at the recording station on the surface. The data can be displayed in analogue form on a direct-writing recorder. Later a study was made on the No. 7 borehole in the Vejrum salt dome, using the same equipment. Measurements were taken between 320 and 990 m. (EG).

37304 (INIS-mf—8936, pp 196-232) **Evaluation of surface and borehole gravity mesurements at the Mors salt dome.** LaFehr, T.R. (Exploration Data Consultants, Inc.). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Surface and borehole gravity data surveyed at the MORS salt dome, Denmark, are analyzed to determine the structure of the dome and the purity of the salt. Previous disagereement between the seismic and gravity interpretations has been resolved in favor of an overhang structure predicted by the seismic work. New developments in borehole gravity meter (BHGM) data analysis have led to a better understanding of the measurements taken in the wells at the MORS salt dome. The apparent density mesured by the BHGM requires new computer software for a complete analysis. The mean density of the salt dome is derived from a combination of the average off-dome densities, a geometric model for the dome, and the average apparent density in the center of the dome. A calculated mean density of 2.2 g/cm^3 suggests the probability that the dome consists of relatively pure rock salt. (EG).

37305 (INIS-mf—8936, pp 233-258) **Halokinesis of salt at Mors salt dome.** Rischbieter, F. (Battelle-Institut e.V.). Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The geological evaluations and the model calculations have shown that the Mors structure is a salt dome at the final stage of development with extremely low values of flow velocity. For a lasting reactivation of diapirism, the necessary supply of bedded salt at the base of the dome is missing. The model calculations yield reasonable values for the flow velocity, in spite of the extremely large range over which the established creep law was extrapolated. It can thus be expected that the application of the creep law for waste disposal scenarios will yield reliable results. (EG).

37306 (INIS-mf—8936, pp 259-263) **Mors salt dome structure attempted interpretation.** Richter-Bernburg, G. Sep 1982. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780263. (CONF-8111198—Pt.1).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

As the salt deposit is the most suitable rock type for high-level wastes disposal, the diapir of Mors is, from a salt geological view, as favourable as is at all possible. The question whether or not, and where, additional drilling activity will be described, depends on the concept of the technical method to be used for the depository. This is not yet decided. (EG).

37307 (INIS-mf—8937, pp 493-502) **Oklo reactors.** Skytte Jensen, B. (Risoe National Laboratory, Roskilde, Denmark. Chemistry Department). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The Oklo reactors comprise up to nine ^{235}U depleted zones in a uranium ore in the Republic of Gabon in West Africa. The depletion in fissile ^{235}U has been proved to have been caused by nuclear chain reactions. The study of the Oklo phenomenon indicates that very efficient retardation mechanisms may operate in nature - at least under special conditions. A closer study of these processes ought to be made to establish the limitations to their occurrence. The Oklo sandstone formation today would probably be considered unacceptable as a host rock for a repository. (EG).

37308 (INIS-mf—8937, pp 264-303) **Hydrogeology of Mors.** Joshi, A.V. (ELSAM, Fredericia, Denmark). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The covering layers protect the salt in the dome. Ground water velocities are small and the chalk exhibits good retention properties for the radionuclides. As ground water velocities below 500 m are small, knowledge of hydrogeology over only a small area over the dome is necessary (1 km horizontal transport takes about 15 mill. years). Additionally if the retention properties of the chalk together with radioactive decay are taken into account, it becomes obvious that the nuclides can travel only a few metres into the chalk, before they have decayed to safe radioactive levels. Therefore it does not appear to be necessary to investigate the hydrogeology beyond a few metres from the disposal area. The hydrogeological investigations that have been carried out, although they cover only a limited area, thus give an excellent and sufficient basis for a safety evaluation for determining the suitability of the Mors salt dome for waste disposal. (EG).

37309 (INIS-mf—8937, pp 304-310) **Hydrogeological field investigations of the geological formations overlying the Mors dome.** Kryger Hansen, H. (Danish Geotechnical Institute). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Published in summary form only.

37310 (INIS-mf—8937, pp 311-332) **Investigations on core samples from the chalk formation overlying the salt dome at Mors.** Skytte Jensen, B. (Risoe National Laboratory, Roskilde, Denmark. Chemistry Department). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The data obtained so far indicate that the chalk formation overlying the salt dome at Erslev, Mors, is extremely efficient as a barrier against the migration of radionuclides, if they ever by unforeseen processes escape their containment in the salt dome. Several questions such as: 1) zero permeability of microporous media at low pressure gradients and 2) the effectiveness of isomorphous substitution (solid solution in surface layers of minerals) are interesting not only from a scientific point of view, but also important when evaluating the safety of the geological disposal of wastes. (EG).

37311 (INIS-mf—8937, pp 333-372) **Chalk reservoirs of the North Sea.** Hardman, R.F.P. (Superior Oil Norge A/S). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

The amount of clay in the chalk, whether primary or secondary, is the factor of greatest importance in determining whether chalk has the capability of forming a reservoir rock or not. It has been empirically observed that the less the clay content the better the reservoir and as has been remarked earlier, the amount of clay in the chalk can be closely correlated with sea level changes. Where other factors are either absent or of only minor importance, the effect of clay is most clearly seen. A good example is well N-2 in Danish waters. It is concluded that in N-2 clay is the dominant control on reservoir quality.

37312 (INIS-mf—8937, pp 373-400) **Groundwater flow and transport calculations for the Mors salt dome.** Pahwa, S.B.; Lafleur, D.W. (INTERA Environmental Consultants, Inc.). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

This paper describes the modeling performed for safety assessment of the Mors Salt Dome site. The first portion of this work involved simulating the regional hydrological flow system in the vicinity of the dome. As much as possible, field data were used to characterize the modeled cross-section. The next step of the modeling work involved constructing several hypothetical scenarios which might cause breachment of the disposal facility. Once the flow fields associated with these scenarios were established, the impact of the breachment upon the environment was evaluated by performing radionuclide migration simulations. (EG).

37313 (INIS-mf—8937, pp 401-411) **Dissolution of the Mors salt dome.** Lindstroem Jensen, K.E. (ELSAM, Fredericia, Denmark). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Regardless of the interpretation of the measured salinity profiles above the Mors salt dome, they can at most be the result of dissolution rates of about 0.004 mm per year. This means that it would take more than 2.5 mill. years to dissolve 10 m of salt. Variations in ground water velocity and cap rock porosity will not significantly change this condition. The stability of the Mors salt dome is therefore not affected by dissolution of the dome. (EG).

37314 **(INIS-mf—8964) Long-term management of high-level radioactive waste. The meaning of a demonstration.** (Nuclear Energy Agency, 75 - Paris (France)). 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701623.

The "demonstration" of the safe management of high-level radioactive waste is a prerequisite for the further development of nuclear energy. It is therefore essential to be clear about both the meaning of the term "demonstration" and the practical means to satisfy this request. In the complex sequence of operations necessary to the safe management of high-level waste, short-term activities can be directly demonstrated. For longer-term activities, such as the long-term isolation of radioactive waste in deep underground structures, demonstration must be indirect. The "demonstration" of deep underground disposal for high-level radioactive waste involves two steps: one direct, to prove that the system could be built, operated and closed safely and at acceptable costs, and one indirect, to make a convincing evaluation of the system's performance and long-term safety on the basis of predictive analyses confirmed by a body of varied technical and scientific data, much of it deriving from experimental work. The assessment of the evidence collected from current operations, existing experience in related fields and specific research and development activities, calls for specialized scientific expertise. Uncertainties in far future situations and probabilistic events can be taken into account in a scientific assessment. Competent national authorities will have to satisfy themselves that the proposed waste management solutions can meet long-term safety objectives. An element of judgement will always be needed in determining the acceptability of a waste disposal concept. However, the level of confidence in our ability to predict the performance of waste management systems will increase as supporting evidence is collected from current research and development activities and as our predictive techniques improve.

37315 **(LA—10101-MS) Geotechnical characteristics of bentonite/sandy silt mixes for use in waste disposal sites.** Abeele, W.V. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015049.

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The coefficient of consolidation for bentonite/sandy silt ratios of 0.04 to 0.14 decreases inversely proportional with the square of that ratio, whereas the compression index, the swelling index, and the permeability change index increase with increasing bentonite ratio. A strong relationship also exists between the void ratio and the logarithm of the applied stress for any given bentonite ratio. The empirical linear relationship between the void ratio and the logarithm of the applied stress, developed by Taylor, is excellent and enables us to limit the evaluation of conductivity at any void ratio to the measurement of the initial and the desired void ratio, the initial conductivity, and the permeability change index. This allows us to read directly, for a given bentonite ratio, the void ratio (or compaction) needed so that a required hydraulic conductivity will prevail. This is crucial in the choice of materials or mixes to be used in a wick system where an established differentiation in hydraulic conductivity is desirable.

37316 **(LA—10125-MS) Testing of lateral water flow in a moisture barrier.** Abeele, W.V.; DePoorter, G.L. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015158.

We have performed large-scale lateral-flow tests in a fine-textured material overlying a coarser medium. The goal was to investigate the effectiveness of a moisture barrier where the finer material has the texture of a silty sand. When we tested for induced lateral flow, a geotextile inhibited penetration of two overlying materials of different particle sizes. Our wick system provided data regarding time to failure of the barriers, but the data are qualitative because of the variance in moisture level around versus below the access tube. 1 reference, 2 figures.

37317 **(LBL—17886) Thermochemical data for nuclear waste disposal.** Phillips, S.L. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 7p. (CONF-8406139—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014570.

From 9. international CODATA conference; Jerusalem, Israel (24 Jun 1984).

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Thermochemical data for nuclear waste disposal are compiled. The resulting data base consists of enthalpy, entropy and heat capacity of formation, and Debye-Huckel coefficients of selected substances for about 25 elements. Values of the data are combined with intrinsic equilibrium constants at 25°C and zero ionic strength to calculate equilibrium quotients to 350°C and 3 ionic strength. $PuSO_4^{2+}$, UOH^{3+} and $UO_2CO_3(aq)$ are given as examples.

37318 **(MAFF-P—2) Radioactive waste disposal policy. Proof of evidence.** Neilson, H.R. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Fisheries Radiobiological Lab.). 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701624.

The responsibilities of the Minister of Agriculture, Fisheries and Food and Ministry policy on radioactive waste disposal are described. The disposal of solid radioactive waste at sea is subject to detailed safeguards developed within two international agreements to which the United Kingdom is a contracting party. The agreements are discussed together with a research and monitoring programme to provide scientific data for informed decisions on waste disposal authorisations and dumping licences.

37319 **(NUREG/BR—0025-Vol.10-No.3) Information report on state legislation. Volume 10, No. 3.** McQuade, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). 24 May 1984. 10p. NTIS, PC A02/MF A01 - GPO*. Order Number DE84901256.

In response to a growing number of inquiries from State officials regarding alternative low-level radioactive waste disposal technologies and the US Nuclear Regulatory Commission (NRC) views on these technologies, the NRC convened a 2-day workshop at the Linden Hill Hotel in Bethesda, Maryland, on May 2-3, 1984. Over 140 persons representing States, Compacts, industry, federal government, and public interest groups met to explore the pros and cons of shallow land burial and alternative disposal concepts for low-level radioactive waste.

37320 **(NUREG/CR—3427-Vol.4) Long-term performance of materials used for high-level waste packaging. Volume 4. Annual report year two, April 1983-April 1984.** Stahl, D.; Miller, N.E. (comps.). (Battelle Columbus Labs., OH (USA)). Jun 1984. 281p. (BMI—2113-Vol.4). NTIS, PC A13/MF A01 - GPO* $7.00. Order Number TI84901512.

As part of the Nuclear Regulatory Commission's requirement to assess the Department of Energy's application to construct geologic repositories for high-level radioactive waste, Battelle's Columbus Laboratories is investigating the long-term performance of materials used for high-level waste packages. The effects on glass waste-form dissolution of temperature, pressure, solution chemistry, and ratio of glass surface area to solution volume have been studied. The glass-dissolution correlation is ready to be evaluated by comparison with experiments. The devitrification correlation has been completed. In canister-corrosion studies, CF8 alloy was found less susceptible to glass attack than Type 304L stainless steel. Limited experiments revealed no corrosion mechanism which would indicate that cast steel could not be used as a corrosion-allowance container material; additional tests with cracking agents are planned. In hydrogen-uptake studies, cast steel was found to absorb more hydrogen than wrought steel. Parts of the general-corrosion correlation have been tested, and work continues on obtaining realistic experimental data as input for it. Gamma fluxes and dose rates in and near the waste package were calculated for CHLW and spent-fuel waste forms. The current water-radiolysis model was found adequate when tested against existing data, and preliminary calculations were performed with the current water-chemistry model; in both cases, additional chemical species are being incorporated. This report documents investigations performed during the period April, 1983 to April, 1984.

37321 **(NUREG/CR—3714) Development of environmental radiation standards for geologic disposal of high-level radioactive wastes.** Kocher, D.C. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 75p. (ORNL—6006). NTIS, PC A04/MF A01 - GPO; GPO Dep. Order Number DE84014402.

This report discusses the different technical issues that must be considered in developing an environmental standard for geologic disposal of high-level radioactive wastes. These issues include: (1) defining acceptable risk; (2) specifying acceptable risk in the standard; (3) formulating the standard so that reasonable demonstrations of compliance can be obtained; (4) applying the standard to protection of individuals or the population; (5) applying the standard to expected occurrences only or to unexpected processes as well; (6) determining a time limit for the standard; and (7) specifying conditions to be assumed for demonstrating compliance. It is concluded that many issues are not resolvable on technical grounds alone, but that an effective standard will allow flexibility and the exercise of subjective scientific judgments in reaching licensing decisions.

37322 **(ORNL/TM—9139) Integrated Data Base Program: a status report.** Notz, K.J.; Klein, J.A. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013604.

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The Integrated Data Base (IDB) Program provides official Department of Energy (DOE) data on spent fuel and radioactive waste inventories, projections, and characteristics. The accomplishments of FY 1983 are summarized for three broad areas: (1) upgrading and issuing of the annual report on spent fuel and radioactive waste inventories, projections, and characteristics, including ORIGEN2 applications and a quality assurance plan; (2) creation of a summary data file in user-friendly format for use on a personal computer and enhancing user access to program data; and (3) opti-

mizing and documentation of the data handling methodology used by the IDB Program and providing direct support to other DOE programs and sites in data handling. Plans for future work in these three areas are outlined. 23 references, 11 figures.

37323 **(PNL-SA—12316) In situ vitrification: a potential remedial action technique for hazardous waste.** FitzPatrick, V.F.; Buelt, J.L.; Oma, K.H.; Timmerman, C.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 16p. (CONF-8406142—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013263.

From Hazardous materials management conference; Philadelphia, PA, USA (5 Jun 1984).

The following conclusions may be drawn from the evaluation of in situ vitrification (ISV) technology: In situ vitrification is a developing technology that may have significant potential for selected hazardous waste disposal. Organic compounds are pyrolyzed during ISV. Subsequent combustion and off-gas treatment hold potential for permanent disposal of selected toxic organic wastes. Process economics for contaminated soil sites at Hanford are in the range of $4 to $6.50/ft^3 of soil vitrified. Differences in site geometry, electrical power costs, soil moisture and other factors can influence these costs. For a soil moisture 25%, and using a portable power supply, costs would be about $9/ft^3 of soil vitrified. Far term (10,000 yr) performance analysis for TRU contaminants leads to the belief that ISV may minimize the effects of persistent toxic and/or heavy metal wastes. When viewing the potential for ISV technology transfer from the nuclear to the hazardous waste arena, it is prudent to remember that ISV appears to be an excellent specific remedial action technique - it is not a panacea, but judiciously applied the process holds promise to mitigate the effects of unprocessed buried chemically hazardous wastes.

37324 **(RHO-BW-SA—326-P) Geohydrologic factors and current concepts relevant to characterization of a potential nuclear waste repository site in Columbia River basalt, Hanford Site, Washington.** Gephart, R.E.; Price, S.M.; Jackson, R.L.; Myers, C.W. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Nov 1983. Contract AC06-77RL01030;W-7405-ENG-36. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014889.

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Geologic features are identified that may affect groundwater movement near a repository located in the Columbia River basalt beneath the Hanford Site, Washington State. These include pathways through flow interiors, flow contacts, and bedrock structural discontinuities. Four concepts are considered to describe groundwater movement in basalt. Differences between concepts principally focus on the degree of vertical leakage through basalt flow interiors. The existing geohydrologic data base is preliminary and is insufficient to conclusively support one groundwater-flow concept over another. However, it is proposed that available data tend to support the existence of distinct groundwater-flow systems having relatively low vertical leakage under low hydraulic-head gradients except where structural discontinuities are present. A number of geohydrologic characterization activities are under way to reduce the present uncertainty regarding potential groundwater pathways. 20 references, 4 figures.

37325 **(RHO-BW-SR—83-1-3Q-P) Basalt Waste Isolation Project drilling and testing. Quarterly report, 1 July 1983-30 September 1983.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1983. Contract AC06-77RL01030. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014881.

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The Rockwell Hanford Operations Drilling and Testing Group is responsible for all borehole drilling and testing conducted in support of the Basalt Waste Isolation Project. Geologic and hydrologic characterization data obtained by the group are an integral part of the studies required to assess the feasibility of using the deep basalts beneath the Hanford Site for the terminal disposal of nuclear waste. This document is a summary of drilling and testing results during the third calendar quarter (July through September 1983). The principal work during this period included the drilling and/or testing of boreholes RRL-2 DC-16A, the McGee Well, DB-2, DH-27, RRL-10, RRL-16, the piezometer borehole clusters, and the Porthole Drilling Demonstration. Specific highlights of this work are summarized.

37326 **(SAND—83-2333) Report of the Fourth interim meeting of the Seabed Working Group Engineering Studies Task Group, 3-6 October 1983, at Rijks Geologische Dienst, Haarlem, The Netherlands.** Talbert, D.M. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015096.

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This report presents the results of the fourth interim meeting of the Seabed Working Group's (SWG) Engineering Studies Task Group (ESTG). This task group is charged with determining whether the engineering technology exists to emplace waste canisters in deep ocean sediments. The fourth interim meeting, held at Rijks Geologische Dienst, Haarlem, The Netherlands, 3-6 October 1983, reviewed progress made by the various national programs since the ESTG third interim meeting (July 1982) and developed a table of requirements for processing samples for a geotechnical properties data base. Other items addressed were (1) potential methods of instrumenting penetrators to obtain in situ measurements, (2) procedures for evaluating and quantifying the disturbed zone created by an emplaced penetrator, (3) review and modification of the current draft version of the SWG Five-Year Plan, (4) review and extension of the ESTG detailed plan for penetrator tests, and (5) details of the penetrator tests scheduled for March 1984 in the Nares Abyssal Plain using the research vessel M/V TYRO. The review of the national programs indicated significant progress when measured against the integrated ESTG five-year plan which results in a joint evaluation of engineering feasibility of subseabed disposal based upon (1) a demonstration of an emplacement capability, (2) an evaluation of the zone of sediment disturbance created during emplacement, (3) the existence of acceptable emplacement models, and (4) an acceptable engineering data base. A table of geotechnical sample-processing requirements is being developed to provide guidance for the other task groups that may have the opportunity to furnish suitable geotechnical samples to the ESTG as well as to provide some measure of consistency within the ESTG for the development of the engineering data base for the SWG study areas.

37327 **(SAND—83-7132) Nevada Nuclear Waste Storage Investigations environmental area characterization report, compiled July 1982.** (Mitre Corp., McLean, VA (USA). METREK Div.). Jul 1984. Contract AC04-76DP00789. 133p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015200.

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The Environmental Area Characterization Report describes the southwestern corner of the Nevada Test Site, Nye County, Nevada, a potential location for a geologic repository for high-level radioactive waste. The characterization summarizes reports supplied by Sandia National Laboratories, which cover the following topics: atmosphere, radiation background, hydrosphere, biosphere, energy and mineral resources, socioeconomics, and cultural resources. This report is one of a series of documents sponsored by the US Department of Energy, Nevada Nuclear Waste Storage Investigations Project. 43 references, 15 figures, 20 tables.

37328 **(UCID—20091) Thermal analysis of NNWSI conceptual waste package designs.** Stein, W.; Hockman, J.N.; O'Neal, W.C. (Lawrence Livermore National Lab., CA (USA)). Apr 1984. Contract W-7405-ENG-48. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014282.

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Lawrence Livermore National Laboratory is involved in the design and testing of high-level nuclear waste packages. Many of the aspects of waste package design and testing (e.g., corrosion and leaching) depend in part on the temperature history of the emplaced packages. This report discusses thermal modeling and analysis of various emplaced waste package conceptual designs including

the models used, the assumptions and approximations made, and the results obtained. 16 references.

37329 **(UCID—20130) Analysis of fracturing in hole UG-2 Spent Fuel Test-Climax.** Thorpe, R.K. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015480.

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Detailed fracture logging and analysis of the UG-2 core from the Climax Stock is reported. This borehole is about 183 m long (600 ft) and slants downward below the Spent Fuel Test workings, thus representing the only sampling of the quartz monzonite at depth. An effective means of orienting the core sections relative to a certain joint set of known orientation is demonstrated, and a computational procedure for accomplyishing this in non-vertical boreholes is presented. Although this core orienting scheme is approximate, modal joint set orientations could be estimated. A distinctive low-angle joint set which pervades the existing workings is the most frequently encountered set at depth, and its spacing distribution is shown to be negative exponential. The next common joint set in the core strikes northeasterly and dips steeply to the southeast. Another set strikes northwesterly and is nearly vertical. These groupings generally agree with results of previous surveys in the area, which suggests the rock mass is homogeneous in terms of its joint pattern. 13 references, 25 figures, 2 tables.

37330 **(WCAP—10574-Vol.1) Decontamination and decommissioning of the Westinghouse nuclear fuel facility at Cheswick, PA. Volume 1 of 2.** Denero, J.V.; Lange, R.A.; Ray, M.L.; Shoulders, J.L.; Woodsum, H.C. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Jun 1984. Contract AC06-82RL10363. 249p. NTIS, PC E09/MF A01; 1; GPO Dep. Order Number DE84013383.

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This report documents the efforts associated with the decontamination and decommissioning of the Westinghouse Nuclear Fuel Facility at Cheswick, Pennsylvania. The facility and its operations, along with non-destructive assay techniques, the management of transuranic waste, and the equipment required for dismantling and packaging these waste, are described. The report also presents detailed plans and procedures that were developed and implemented for this effort. The construction and use of a sectioning facility for large contaminated items is also discussed, and the results of the radiological survey are summarized. Finally, recommendations are given for the decontamination and decommissioning of existing facilities and for the design and construction of new facilities. Volume I contains: site/facility description; project summary; project scheduling and organization; final site condition; conclusions and recommendations; references; Appendix A - contaminated equipment contained in PFDL facility; and Appendix B - PFDL operating procedures, PFDL administrative procedures, PFDL analytical laboratory procedures, and Cheswick site industrial hygiene procedures. 7 references, 101 figures, 25 tables.

37331 **(WCAP—10574-Vol.2) Decontamination and decommissioning of the Westinghouse nuclear fuel facility at Cheswick, PA. Volume 2 of 2.** Denero, J.V.; Lange, R.A.; Ray, M.L.; Shoulders, J.L.; Woodsum, H.C. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Jun 1984. Contract AC06-82RL10363. 132p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84013382.

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This report documents the efforts associated with the decontamination and decommissioning of the Westinghouse Nuclear Fuel Facility at Cheswick, Pennsylvania. The facility and its operations, along with non-destructive assay techniques, the management of transuranic waste, and the equipment required for dismantling and packaging these waste, are described. The report also presents detailed plans and procedures that were developed and implemented for this effort. The construction and use of a sectioning facility for large contaminated items is also discussed, and the results of the radiological survey are summarized. Finally, recommendations are given for the decontamination and decommissioning of existing facilities and for the design and construction of new facilities. Volume II contains the following Appendices: Appendix C - requests for approval and drawings for galvanized drums, epoxy coated corrugated steel boxes, fiberglass-reinforced polyester-coated plywood boxes, non-TRU waste containers; Appendix D - certificates of compliance for overpacks; Appendix E - training program on use of full-face respirators; Appendix F - radiological survey measurement equipment; Appendix G - health physics checks on decontaminated areas identified in ORAU/NRC survey; and Appendix H - tooling, equipment, and supplies.

37332 **(ZfK—506) Potassium/sodium ion exchange of sodium aluminosilicate and soda-lime glasses with potassium nitrate melts.** Richter, E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Aug 1983. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701522.

The alkali self-diffusion coefficients, the concentration-dependent interdiffusion coefficients, and the actual equilibrium constants of the ion exchange process were determinated for model glasses of the Na_2O-Al_2O_3-SiO_2 type and the Na_2O-CaO-SiO_2 type by nuclear techniques. The measured self-diffusion data and interdiffusion coefficients were used to estimate the stress profiles initiated by the K/Na exchange below the transformation temperature in the surface region. The activation volume of the sodium and potassium ions for diffusion through the surface zone stressed by ion exchange was determined. The disturbing influence of small concentrations of determined divalent cations in KNO_3 (especially Ca^{2+}) was investigated and thermodynamically described. Possibilities were demonstrated to remove these disturbances by anionic admixtures to the KNO_3 melt. Conclusions were drawn for the technical process of the chemical strengthening of glass by K/Na ion exchange at lower temperatures.

37333 **Stored energy in a radioactive waste borosilicate glass: Its frequency factor and kinetics and its source.** Primak, W.; Roberts, F.P. (Argonne National Laboratory, Argonne, IL). *Nuclear Science and Engineering;* **86**: No. 2, 191-205(Feb 1984).

Data for the differential thermal analysis (DTA) of a borosilicate glass (designed to incorporate high-level nuclear waste and designated 76-68) subjected to radiation damage by its curium content, are presented. The DTA curves for previously isothermally annealed samples can be explained by a distribution of processes in activation energy with a frequency factor about 10^{14}. The theory of uniform isothermal damaging is extended to the cases of saturating and decaying damaging. The beginning of the observed DTA curves cannot be explained in this simple manner. The theory of the annealing in a thermal spike associated with the recoiling radioactively decaying curium atoms is presented and appears to account for one of the features of the DTA curve. Other features appear to involve annealing during damaging with temperature gradients in the material associated with the self-heating during radioactive decay. However, these do not explain all of the features of the DTA curves, and, in particular, the low initial slope. It is suggested that the possibility of a radiation-enhanced annealing associated with ionization be considered. The stored energy saturates very early in the damaging. If the stored energy is associated with the actinide recoils, they would have to have a 60-A effective radius of action, about that of 2-keV displaced atoms; if it is associated with the emitted alpha particles, they would have to have a 3- to 5-A radius of action, corresponding to displacing individual atoms along their paths. Following a comparison with the behavior of ion-bombarded vitreous silica and silicate glasses, it is suggested that the stored energy is associated with fracture of network bonds.

37334 **Environmental pathways analysis for evaluation of a low-level waste disposal site.** Lee, D.W.; Ketelle, R.H.; Pin, F.G.; Hill, G.S. (Oak Ridge National Lab., TN (USA)). pp 363-379 of Radioactive waste management. Vol. 4. Proceedings of an international conference held by the IAEA in Seattle, 16-20 May 1983. Vienna, Austria; IAEA (1984). (CONF-830523—).

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

The suitability of a site for the shallow land burial of low-level waste is evaluated by an environmental pathways analysis. The environmental pathways analysis considers the probable paths for the transport of contamination to man and models the long-term transport of contamination to determine the resulting dose to man. The model of the long-term transport of contamination is developed for a proposed site using data obtained from a comprehensive laboratory and field investigation. The proposed site is located at the US Department of Energy Portsmouth Reservation, Piketon, Ohio, and is planned to accept low-level radioactive waste generated by the enrichment of uranium. Laboratory studies were performed to characterize the waste and determine the wastes' leaching and retardation characteristics with site soils and groundwater. Comprehensive drilling, sampling and laboratory investigations were performed to provide the necessary information for interpreting the site's geology and hydrology. Field tests were performed to further quantify the site's hydrology. The pathway of greatest concern is the migration of contaminated groundwater and subsequent consumption by man. This pathway was modelled using a numerical simulation of the long-term transport of contamination. Conservative scenarios were developed for leachate generation and migration through the geohydrologic system. The dose to man determined from the pathways analysis formed the basis for evaluating site acceptability and providing recommendations for site design and development.

37335 **Modelling long-term aspects of nuclear waste disposal: The AEGIS experience.** Dove, F.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). pp 231-239 of Radioactive waste management. Vol. 4. Proceedings of an international conference held by the IAEA in Seattle, 16-20 May 1983. Vienna, Austria; IAEA (1984). (CONF-830523—; IAEA-CN—43/279). Contract AC06-76RL01830.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Modelling the long-term aspects of nuclear waste disposal has its roots in risk analysis of man-made systems such as nuclear reactors. Analytical problems can be introduced into the performance assessment of a site-specific repository if an appreciation for the behaviour of a natural earth system is not maintained. However, this should not preclude the application of historically useful analytical techniques, such as bounding strategies, in favour of emerging, data-intensive techniques. The technical challenge is to apply existing technology and available data to a complex problem and produce a useful result.

37336 **Acoustic emissions during deformation of jointed rock.** Holcomb, D.J.; Teufel, L.W. (Sandia National Laboratories, Albuquerque, NM). *Series on Rock and Soil Mechanics;* **8**: 37-44(1984). (CONF-811036—). Contract AC04-76DP00789.

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

As an aid to understanding and monitoring the behavior of jointed rock masses, we have done a series of experiments on samples of Grouse Canyon tuff containing sawcut joints. The tuff was selected because it is under consideration as a disposal medium for nuclear wastes. The samples were instrumented to measure axial and transverse displacements and AE rates. Testing was done in a servocontrolled machine at displacement rates of 2×10^{-5} in/sec, and confining pressures ranging from 1500 to 6000 psi. Four modes of slip on joints were identified. First, stable sliding accompanied by a steady rate of AE. Second, stick-slip with a sharp drop in load, large displacements but no premonitory AE or slip. Third, stick-slip, as in mode 2, but with premonitory AE and slip. Fourth, stable stick-slip where the load dropped and the displacements increased but the process was slow and culminated in stable sliding. Mode 4 exhibited premonitory AE and slip and after the event, a steady rate of AE during sliding. In all cases where premonitory slip or stable sliding occurred there was a corresponding occurrence of AE, indicating slip is related to damage to the joint surfaces and adjacent material. Monitoring AE would be a useful method of detecting slip and the extent of slip in modes 1, 3, and 4. Increasing slip rate leads to increasing AE rate. However, mode 2 stick-slip appears to be undetectable by this method.

37337 **Application of modern seismological methods to acoustic emission studies in a rock mass subjected to heating.** Majer, E.L.; King, M.S.; McEvilly, T.V. (Lawrence Berkeley Lab., CA). *Series on Rock and Soil Mechanics;* 494-516(1984). (CONF-811036—). Contract W-7405-ENG-48.

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

Modern seismological methods developed to study microearthquake phenomena are being utilized in an acoustic emission (AE) experiment designed to investigate the mechanical behavior of hard crystalline rock subject to heating by high-level nuclear waste. The sensors consist of a fifteen-station, three-dimensional array (dimensions: 50 m x 20 m x 10 m) of accelerometers surrounding eleven canisters of spent nuclear fuel and six electrical heaters simulating spent-fuel canisters. The canisters are arranged in a linear array in the Climax stock at the Nevada Test Site, at a subsurface depth of 420 m. The data are digitized and analyzed in situ by an Automated Seismic Processor (ASP) developed for microearthquake studies, using a 15-channel transient waveform recorder system to convert from the high-frequency (1kHz to 10kHz) AE events. Velocity and attenuation control within the rock mass is provided by a controlled-pulse piezoelectric source located centrally within the sensor array. This paper discusses the theoretical basis for studies of the AE source characteristics, a description of the instrumentation employed and a review of results obtained over the first 18 months of operation of the facility.

37338 **The reduction of neptunium(VI) by basalt and olivine.** Susak, N.J.; Fried, S.; Friedman, A.; Sullivan, J.C. (Argonne National Laboratory, Argonne, IL). *Nuclear Technology;* **63**: No. 2, 266-270(Nov 1983).

The interaction of Np(VI) in 0.1 M $NaHCO_3$ solution, distilled water, or artificial seawater with basalt or olivine results in the production of Np(V) and Np(IV). The rate of increase in Np(V) was determined over periods of 120 (olivine substrates) and 140 days (basalt substrates). The Np(V) that does not remain in solution is preferentially adsorbed on the surface of the minerals as compared to the surface of the containers. The mechanism for the production of Np(IV) and Np(V) postulates adsorption and desorption steps for the aquo Np(VI) and Np(V) ions on to the silicate surface. The electron transfer reaction takes place when the Np(VI) or Np(V) is adsorbed on this surface at an Fe(II) site. Reduced neptunium ions are then adsorbed from the solid.

37339 **Disposal rabbit.** Lewis, L.C.; Trammell, D.R. (to Dept. of Energy). US Patent Application 6-541,186. 12 Oct 1983. 9p. Contract AC07-79ID01675.

A disposable rabbit for transferring radioactive samples in a pneumatic transfer system comprises aerated plastic shaped in such a manner as to hold a radioactive sample and aerated such that dissolution of the rabbit in a solvent followed by evaporation of the solid yields solid waste material having a volume significantly smaller than the original volume of the rabbit.

37340 **Implementation of the Nuclear Waste Policy Act.** Washington, DC; Government Printing Office (1983). 307p.

A series of 14 witnesses and panelists testified on DOE's efforts to characterize the Hanford nuclear waste site, the status of federal and state relations in regard to nuclear waste management, New Mexico's experience in working with DOE on an intermediate-level waste facility, and a timetable for implementing the Nuclear Waste Policy Act. Panelists and witnesses represented the affected states, Indian tribes, state and federal agencies, consultants, and members of Congress. An appendix with additional material and comments follows their testimony.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 05300037256, 37264, 37310, 37312, 37324, 37334, 38429, 38433, 38435, 38478, 38479

37341 **(INIS-mf—8987) Evaluation by Geological Survey of Denmark of salt deposit investigations accomplished by ELKRAFT and ELSAM. Pt. 1. The importance of geological and hydrological conditions for geological disposal of high level radioactive wastes. Prepared for the Danish Environmental Agency.** (Danmarks Geologiske Undersoegelske, Copenhagen). 1982. 17p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780478.

A large area of pure sodium chloride with scattered anhydrite ($CaSO_4$) traces and water concentration between 0 and 0.1% is localized by means of two deep drillings at Mors (Denmark). The Geological Survey of Denmark was requested to reevaluate the results of exploration undertaken by the Danish electric utilities concerning usefulness of salt deposits as final radioactive waste disposal site. The Geological Survey of Denmark has reservations about possible aquifers and water flow in the Mors salt deposits and indicates consequences of possible radioactive effluents for biosphere. Volumes II and III comprehend detailed argumentation for the viewpoint of the Geological Survey of Denmark, based on hydro- and geological conditions at Mors.

37342 **(INIS-mf—8988) Evaluation by Geological Survey of Denmark of salt deposit investigations accomplished by ELKRAFT and ELSAM. Pt. 2. The importance of geological and hydrological conditions for geological disposal of high level radioactive wastes. Prepared for the Danish Environmental Agency.** (Danmarks Geologiske Undersoegelske, Copenhagen). 1982. 144p. (In Danish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780479.

Knowledge of geological conditions at the Mors (Denmark) salt deposits is of primary importance for evaluation of their usefulness as final disposal site for radioactive wastes. Critical evaluation of the known and presumed factors affecting temperature, pressure, man-made and natural processes is accomplished on the basis of exploration results supplied by the Danish electric utilities. Permeability conditions depend on tectonic processes and diagnesis and first, when these processes are elucidated, the risks of radioactive contamination of groundwater can be estimated. Zechstein formations are characterized with special regard to Mors salthorst and deep underground disposal.

37343 **(INIS-mf—8989) Evaluation by Geological Survey of Denmark of salt deposit investigations accomplished by ELKRAFT and ELSAM. Pt. 3. The importance of geological and hydrological conditions for geological disposal of high level radioactive wastes. Prepared for the Danish Environmental Agency.** (Danmarks Geologiske Undersoegelske, Copenhagen). 1982. 144p. (In Danish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780480.

The principle of geological disposal of high-level radioactive wastes in salt deposits is based on safety of such disposal. The Danish electric utilities have prepared alternative scenarios of waste disposal presuming a barrier system stopping any contamination from the disposal site. Technical barriers comprehend waste solidification, vitrification ets. containers, technical shape of the site and protection systems. Geological barriers consist of the primary salt barrier and secondary geological layer barriers around the salthorst. The Geological Survey of Denmark evaluated the proposed barrier systems and investigated geological and hydrological related mechanisms into biosphere.

37344 **(LA—9445-PNTX-N) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: decontamination methods and cost estimates for postulated accidents.** Wenzel, W.J. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008073.

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This report documents work performed in support of preparation of an Environmental Impact Statement regarding the Department of Energy's Pantex Plant near Amarillo, Texas. Methodology and costs for decontamination following a postulated nonnuclear detonation of a nuclear weapon are presented for three land use categories: agricultural, surburban, and commercial. Seven postulated releases of plutonium are addressed: three at the Pantex Plant (120, 30, and 0.625 kg), three at the Iowa Army Ammunition Plant (IAAP) (120, 30, and 0.625 kg), and one at the Hanford Site (0.625 kg).

37345 **(LA—9667-MS) TRACR3D: a model of flow and transport in porous/fractured media.** Travis, B.J. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 191p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84015058.

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This report describes the TRACR3D computer code, which solves the equations of transient two-phase flow and multicomponent transport in deformable, heterogeneous, reactive porous/fractured media. Solution is obtained by an implicit finite difference scheme for flow and a semi-implicit approach for transport. This report describes the equations of the model, defines the numerical solution procedure, presents partial verification and validation of the model, and includes a user's guide. TRACR3D can be used to study radioactive waste migration from repositories in unsaturated and saturated geology, chemical waste storage, soil water movement, and tests that define hydrocarbon reservoir structure. 23 figures.

37346 **(LA—10121-PR) Laboratory and field studies related to the radionuclide migration project. Progress report, October 1, 1982-September 30, 1983.** Daniels, W.R.; Thompson, J.L. (comps.). (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015075.

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The FY 1983 laboratory and field studies related to the Radionuclide Migration project are described. Results are presented for radiochemical analyses of water samples collected from the RNM-1 well and the RNM-2S satellite well at the Cambric site. Data are included for tritium, ^{36}Cl, ^{85}Kr, ^{90}Sr, ^{129}I, and ^{137}Cs. Preliminary results from water collection at the Cheshire site are reported. Laboratory studies emphasize the sorptive behavior of tuff and its dependence on mineralogy. 18 references, 7 figures, 13 tables.

37347 **(NUREG/CR—3838) Initial review of several meteorological models suitable for low-level waste disposal facilities.** Culkowski, W.M. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.). Jun 1984. 21p. NTIS, PC A02/MF A01 - GPO* $3.25. Order Number TI84901535.

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Several mathematical models of the meteorological aspects of effluent releases have been examined for relevance to Low Level Waste disposal programs. The principal models, by Dames and Moore, Inc., Science Applications, Inc., Argonne National Laboratory, and Oak Ridge National Laboratory, contain provisions for various combinations of wind erosion, area, and point source configurations as well as deposition and elevated releases. Methods employed by these models are compared for relevance, availability of supporting data and potential benefit versus cost.

37348 **(SKBF-KBS-TR—83-18) Migration experiments in Studsvik.** Landstroem, O.; Klockars, C.E.; Persson, O.; Tullborg, E.L.; Larsson, S.A.; Andersson, K.; Allard, B.; Torstenfelt, B. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Jan 1983. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701625.

Field experiments (two-well pulse method) on the migration of Sr and Cs in a gneiss at Studsvik on the Swedish east coast as well as supporting laboratory measurements on sorption/migration have been performed. Interconnected fractures at about 100 m

depth between boreholes were located and characterized. In the boreholes measurements of resistivity, spontaneous potential, pH, Eh, curvature, temperature, gamma radiation, and radon have been performed. The fracture zones were localized, using TV-logging, and the mineralogy of the water-bearing fractures in a drill core from the area determined. The main fissure-filling minerals were chlorite, calcite and smectite. The groundwater composition was analyzed and it was found that the water in some cases is oversaturated with respect to calcium carbonate. Temperatures up to 12°C of the pumped water have been observed, corresponding to water originating from 200-400 m depth. In laboratory batch measurements it was found that the distribution coefficient for Studsvik gneiss and possible fissure-filling minerals was 0.01-0.4 m^3/kg. The sorption isotherm for the gneiss was almost linear, a Freundlich isotherm with the exponent 0.89 fits well to the data. In two field experiments, performed between different boreholes, retention factors for Sr of 17 and 30, respectively, were obtained. In laboratory column experiments, performed on crushed borehole material, the retention factor was 30-35, corresponding to a distribution coefficient of 0.006-0.008 m^3/kg. For Cs, injected simultanously with the Sr, the retentionfactor is > 30. (No breakthrough after 5000 h.). In both the field experiments a minor amount of the Sr was migrating almost without retention (retention factor < 2). This effect was not observed for Cs, indicating that the process causing the fast transport of Sr is selective to Sr.

37349 Review of global environmental transport models for ^3H, ^{14}C, ^{85}Kr, and ^{129}I. Kocher, D.C.; Killough, G.G. (Oak Ridge National Lab., TN (USA)). pp 181-196 of Radioactive waste management. Vol. 5. Proceedings of an international conference held by the IAEA in Seattle, 16-20 May 1983. Vienna, Austria; IAEA (1984). (CONF-830523—; IAEA-CN—43/419). Contract W-7405-ENG-26.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Global environmental transport models for the long-lived and mobile radionuclides ^3H, ^{14}C, ^{85}Kr, and ^{129}I are reviewed from the perspective of their application to collective dose assessments following releases, e.g. from the nuclear fuel cycle. For atmospheric releases of these radionuclides from a localized source, we also compare the contributions to the collective dose commitment from long-term global transport with those from first-pass local and regional exposures. Current global models for ^{14}C and ^{85}Kr appear to be satisfactory for dose assessment purposes. Global modelling for ^3H is more difficult than for ^{14}C and ^{85}Kr, because of the different physico-chemical forms in which atmospheric releases occur (e.g. HTO and HT), the rapid removal of HTO from the atmosphere to the land or ocean surface, and the slow transport of ^3H on the land surface and in ocean waters. Current models have only been partially successful in reproducing environmental data on ^3H from nuclear weapons testing. Global models for ^{129}I which are based on the global iodine cycle have only recently been developed. These models indicate the primary importance of ^{129}I retention in surface soils for collective doses during the first 10^4 years following atmospheric releases and the importance of long-term transport to ocean sediments for reducing the dose commitment. Even though these radionuclides persist in man's exposure environment for times ranging from 10^2 to 10^8 years, it may still be more sensible to establish release limits by emphasizing doses to maximally exposed individuals in the vicinity of the release location more than global collective doses or dose commitments, because of the very low doses experienced by average individuals in the world population.

0540 Health And Safety

REFER ALSO TO CITATION(S) 05400037269, 37270, 37271, 37321, 37659, 37802, 38478, 38479

37350 (BMI/ONWI—532) Communication measures to bridge ten millennia. Sebeok, T.A. (Indiana Univ., Bloomington (USA). Research Center for Language and Semiotic Studies). Apr 1984. Contract AC02-83CH10140. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014459.

The Department of Energy created the Human Interference Task Force (HITF) in 1980 to investigate the problems connected with the postclosure, final marking of a filled nuclear waste repository. The task of the HITF is to devise a method of warning future generations not to mine or drill at that site unless they are aware of the consequences of their actions. Since the likelihood of human interference should be minimized for 10,000 years, an effective and long-lasting warning system must be designed. This report is a semiotic analysis of the problem, examining it in terms of the science or theory of messages and symbols. Because of the long period of time involved, the report recommends that a relay system of recoding messages be initiated; that the messages contain a mixture of iconic, indexical, and symbolic elements; and that a high degree of redundancy of messages be employed.

37351 (CONF-840614—78) Comparison of potential health and safety impacts of different disposal options for defense high-level wastes. Kocher, D.C.; Smith, E.D.; Witherspoon, J.P. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014295.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

A comparative assessment has been performed of the potential long- and short-term health and safety impacts of different disposal options for defense high-level wastes. Conservative models and assumptions were used. The assessment suggests that considerations of health and safety will not be significant in choosing among disposal options, primarily because of the need to meet stringent standards in all cases. Rather, the ease and cost of assuring compliance of a particular disposal option with health and safety standards may be a more important factor. 11 references.

37352 (INIS-mf—8937, pp 519-524) Natural events and human intrusion. Lindstroem Jensen, K.E. (ELSAM, Fredericia, Denmark). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Scenario analyses have shown that the salt dome Mors has an inherent safety. The Mors dome profits from two natural barriers. The salt as the primary and absolute barrier and the limestone as the secondary and retaining barrier. The drilling hole scenario has shown that the combination of two failed natural barriers acts as a barrier. The scenario analyses have demonstrated fundamental physical mechanisms, which probably are responsible for the existence of the Mors salt dome during millions of years. We expect the same mechanisms will continue in the future. (EG).

37353 (INIS-mf—8937, pp 525-532) Conclusion of safety evaluation. Pedersen, A. (ELSAM, Fredericia, Denmark). Sep 1982. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780262. (CONF-8111198—Pt.2).

From Symposium on geological investigations for high-level waste disposal in the Mors Salt Dome; Copenhagen, Denmark (18 Nov 1981).

Results of the salt deposit safety evaluation are compared with a proposed set of Danish general criteria for high-level waste disposal prepared by the Danish environmental agency. There are three main criteria: 1. Natural transport mechanisms should not give pollution which is impermissible according to present regulations. The here referred investigations confirmed that the situations considered will not even destroy the steel contaners around the waste. 2. Violent natural phenomena should not give releases which result in a health risk to the population which is significant compared to other man-made and natural risks. No relevant natural event or major geological change which might destroy the steel containers around the waste was found. 3. The probability of future human intrusion into the repository should be small, and the ensuing health risk to the population should be negligible compared to other man-made risks. We have not directly quantified the probability of intrusion. But it has to be very small. In North Jutland there are at least 10 salt domes with the salt mirror closer to the surface than Mors. They represent an area of $500 \times 10^6 m^2$. The releases we have found for the human intrusion cases result in dose rates ranging from nothing to 1/2 rem/year. The health effects of such dose

rates are extremely small and the health risk accordingly negligible. (EG).

37354 (NUREG/CR—3775) Quality assurance for measurements of ionizing radiation. Eisenhower, E.H. (ed.). (National Bureau of Standards, Washington, DC (USA)). Jun 1984. 164p. NTIS, PC A08/MF A01 - GPO $5.50. Order Number TI84901287.

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This report describes a program to improve, demonstrate, and document trace-ability of its measurements to the national physical measurement standards for ionizing radiation. The principal actions taken were: (1) characterization of the response of a thermoluminescence dosimetry system used for routine surveillance of nuclear facilities; (2) characterization of the response of six models of portable survey instruments; and (3) implementation of routine quality assurance services that will demonstrate that laboratories which calibrate survey instruments for the NRC are sufficiently consistent (in agreement) with national measurement standards. Tests of the TLD system were performed as specified in American National Standard N545-1975, plus several additional tests not contained in that document. Measurement assurance tests were conducted for the NRC Region-1 laboratory. The response of the survey instruments was determined for photon energies as high as 6.5 MeV, and for beta particles of various energies, including those emitted by ^{133}Xe gas. The basic principles under which the long-range interactive MQA program will operate were developed and documented, and the feasibility of the program was demosntrated. 14 references, 46 figures, 49 tables.

0550 Regulations

REFER ALSO TO CITATION(S) 05500037260, 37268, 37294, 37295, 37321, 37536, 37558

37355 (AERE-SRDP-R—111) Monitoring the ^{235}U enrichment of uranium deposited on pipes in centrifuge plants operating at low pressures using a high resolution gamma-ray spectrometer. Packer, T.W. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jan 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702576.

Methods are described for determining the ^{235}U enrichment of uranium deposited on pipes in centrifuge plants operating at low pressures using a γ-ray spectrometer. Results of measurements made on eight centrifuge cascades that had been in operation for several years are given. It is shown that the ratio of the number of 84 keV γ-rays emitted by ^{231}Th, a daughter of ^{235}U, to the number of 63 keV γ-rays emitted by ^{234}Th, a daughter of ^{238}U, enables the ^{235}U enrichment of the deposited uranium to be determined without the inspector needing to know the operating pressure of the centrifuge. It is possible to determine the ^{235}U enrichment of the uranium deposited on product pipes to within +-5% relative of the average declared value in a measurement time of 4 hours when using a high resolution γ-X semi-conductor detector. The presence of directly deposited thorium fluoride on the pipes has been established. As the ratio of the number of $^{231}Th/^{234}Th$ atoms deposited is a measure of the enrichment of the UF_6 gas currently being produced, it also enables gross misuse of the centrifuge plant during the period of inspection to be detected.

37356 (CONF-840734—6) Activated barrier for protection of special nuclear materials in vital areas. Timm, R.E.; Miranda, J.E.; Reigle, D.L.; Valente, A.D. (Argonne National Lab., IL (USA)). 15 Jul 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014724.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

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The Argonne National Laboratory and Sandia National Laboratory have recently installed an activated barrier, the Access Denial System (ADS) for the upgrade of safeguards of special nuclear materials. The technology of this system was developed in the late 70's by Sandia National Laboratory-Albuquerque. The installation was the first for the Department of Energy. Subsequently, two additional installations have been completed. The Access Denial System, combined with physical restraints, provide the system delay. The principal advantages of the activated barrier are: (1) it provides an order of magnitude improvement in delay over that of a fixed barrier, (2) it can be added to existing vital areas with a minimum of renovations, (3) existing operations are minimally impacted, and (4) health and safety risks are virtually nonexistent. Hardening of the vital areas using the ADS was accomplished in a cost-effective manner. 3 references, 1 figure, 1 table.

37357 (IEAL-R—84-7-Vol.1) Siting provisions of the U.S. Nuclear Waste Policy Act vs related experience in other countries. Volume I. Paige, H.W. (International Energy Associates Ltd., Washington, DC (USA)). 25 Jan 1984. Contract AC01-83NE44341. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84015317.

During the past few years a series of surveys has been conducted by International Energy Associates Limited (IEAL) for the U.S. Department of Energy, documenting the approaches and progress in other democracies in dealing with the problems of obtaining siting approvals for nuclear waste facilities. Many of these countries are further along in this process than is the U.S., and the objective of the surveys was to make available to those drafting U.S. nuclear waste policy the lessons learned by others which appeared to have potential applicability within the U.S. political system. This objective was accomplished by distribution of the survey results to members of Congress and in ensuing discussions with staff during the period when the Nuclear Waste Policy Act was being drafted. Now that the Act has been passed into law there is an opportunity to compare its provisions in their final form with the lessons learned from the surveys. It was felt that such a comparison could be useful, not only in identifying those siting provisions in the Act which were, or were not, in keeping with the lessons learned, but also by calling attention to areas which may not have been given the degree of emphasis that experience in other countries would indicate as desirable. To the extent that these findings are found to be helpful to those currently preparing the Mission Plan, it is hoped that they could contribute to effective implementation of the Act. Volume I contains the executive summary and summary of lessons learned from surveys of other countries.

37358 (IEAL-R—84-7-Vol.2) Siting provisions of the U.S. Nuclear Waste Policy Act vs related experience in other countries. Volume II. Paige, H.W. (International Energy Associates Ltd., Washington, DC (USA)). 25 Jan 1984. Contract AC01-83NE44341. 63p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84015347.

During the past few years a series of surveys has been conducted by International Energy Associates Limited (IEAL) for the U.S. Department of Energy, documenting the approaches and progress in other countries (all the European nuclear democracies, plus Japan, Mexico, Canada) in dealing with the problems of obtaining siting approvals for nuclear waste facilities. Many of these countries are further along in this process than is the U.S., and the objective of the surveys was to make available to those drafting U.S. nuclear waste policy the lessons learned by others which appeared to have potential applicability within the U.S. political system. This objective was accomplished by distribution of the survey results to members of Congress and in ensuing discussions with staff during the period when the Nuclear Waste Policy Act was being drafted. Now that the Act has been passed into law there is an opportunity to compare its provisions in their final form with the lessons learned from the surveys. It was felt that such a comparison could be useful, not only in identifying those siting provisions in the Act which were, or were not, in keeping with the lessons learned, but also by calling attention to areas which may not have been given the degree of emphasis that experience in other countries would indicate as desirable. Volume II contains: background and purpose; methodology; analysis of siting provisions of the Act vs lessons learned in other countries; notes re analysis; and errata.

37359 **(IS—4557) Optical assay technology for safeguards. Quarterly report, October 1-December 31, 1983.** Edelson, M.C.; Fassel, V.A. (Ames Lab., IA (USA)). Apr 1984. Contract W-7405-ENG-82. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014878.

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The spectroscopy of Pu was further studied this quarter and the isotopic splitting of two Pu lines was successfully resolved. The construction of a glove box-housed ICP and new work on the determination of B and Cd in U for ICP-AES were described in two recent reports, which are included as appendices to this report.

37360 **(LA—9964-Vol.1) Design and evaluation of an integrated safeguards system. Volume I. Principles.** Markin, J.T.; Coulter, C.A.; Gutmacher, R.G.; Thomas, C.C. Jr.; Whitty, W.J. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 128p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84015072.

An integrated safeguards system is defined as a collection of safeguards activities in which system components are coordinated to meet safeguards objectives efficiently within constraints imposed by safeguards resources, facility operations, potential adversaries, and regulatory requirements. This report describes principles for designing and evaluating an integrated safeguards system that consists of four parts: (1) a problem definition phase that specifies resources and constraints composing the problem boundary values, (2) a system analysis/synthesis phase that describes how to select and integrate safeguards activities for efficient attainment of system objectives, (3) a system evaluation/optimization phase that defines measures of safeguards performance and develops methods for evaluating them, and (4) a decision-making phase that develops principles for selecting admissible designs and preference-ordering designs. 58 references, 7 figures, 6 tables.

37361 **(LA—9964-Vol.2) Design and evaluation of an integrated safeguards system. Volume II. Example application of the principles.** Coulter, C.A.; Markin, J.T. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015048.

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To illustrate the use of the design and evaluation methods that have been described in Vol. I, we apply these methods to a hypothetical vault building intended to store Category I quantities of special nuclear material at a DOE facility. The problem definition and system analysis/synthesis phases of the design process are used to construct two possible designs for the vault building. The semiquantitative methods presented in Vol. I for evaluating detection and interruption performance of safeguards systems are then applied to these two designs. In addition, sources of additional costs and of possible operational interference due to the safeguards system are identified, and a catalogue of DOE regulations applicable to the vault building is given. From the evaluation process, we conclude that one of our designs is superior to the other but that neither one provides satisfactory interruption performance against certain adversary scenarios. Safeguards system modifications that might be considered in the next iteration of the design process are given. 1 reference, 6 figures, 21 tables.

37362 **(NLCO—2004) Results of the NLO error-propagation exercise.** Gessiness, B.; Lower, C.W.; Porter, G.K. (NLO, Inc., Cincinnati, OH (USA)). 15 Jun 1984. Contract AC05-76OR01156. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014921.

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The successful conclusion of the Error Propagation Exercise, started 2 years ago at NLO, Inc.'s Feed Materials Production Center, Fernald, Ohio, was reached when a statistically based LEID was determined in a controlled balance area, processing low enriched uranium materials. The three-month test demonstrated that it is possible even in a high-throughput bulk processing facility to collect and process all data necessary for computation of a rigorously determined LEID without interference with production and without significant cost increases. The exercise further demonstrated that much of the data necessary are already collected for other routine uses (e.g., production control, measurement quality control, etc.) so that only a modest increase in data collection is necessary. The automated data collection system developed showed that the additional data can be collected quickly, accurately, and relatively cheaply using readily-available commercial hardware. The benefits of error propagation in terms of increased confidence in nuclear materials safeguards are clear; plans have been developed to extend error propagation to all the enriched uranium processing areas of the Feed Materials Production Center. 6 references, 3 figures.

37363 **(NRC—4901153-Rev.1) Nondestructive assay of special nuclear material contained in scrap and waste. Revision 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Apr 1984. 17p. NTIS, PC A02/MF A01 - GPO*. Order Number TI84901153.

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Section 70.51, Material Balance, Inventory, and Records Requirements, 10 CFR Part 70, Domestic Licensing of Special Nuclear Material, requires licensees authorized to possess at any one time more than one effective kilogram of special nuclear material (SNM) to establish and maintain a system of control and accountability to ensure that the standard error (estimator) of any inventory difference (ID) ascertained as a result of a measured material balance meets established minimum standards. The selection and proper application of an adequate measurement method for each of the material forms in the fuel cycle is essential for the maintenance of these standards. For some material categories, particularly scrap and waste, nondestructive assay (NDA) is the only practical, and sometimes the most accurate, means for measuring SNM content. This guide details procedures acceptable to the NRC staff to provide a framework for the use of NDA in the measurement of scrap and waste components generated in conjunction with the processing of SNM. Other guides detail procedures specific to the application of a selected technique to a particular problem. 26 references, 4 tables.

37364 **(NUREG—0525-Rev.9) Safeguards Summary Event List (SSEL), Pre-NRC through December 31, 1983. Rev. 9.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jun 1984. 51p. NTIS, PC A04/MF A01 - GPO $4.25. Order Number TI84901542.

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The Safeguards Summary Event List (SSEL) provides brief summaries of several hundred safeguards-related events involving nuclear material or facilities regulated by the US Nuclear Regulatory Commission (NRC). Events are described under the categories of bomb-related, intrusion, missing/allegedly stolen, transportation, tampering/vandalism, arson, firearms-related, radiological sabotage and miscellaneous. The information contained in the event descriptions is derived primarily from official NRC reporting channels.

37365 **(SAND—84-0501C) Valve monitor designs for security applications.** Curlee, R.M.; Mangan, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 4p. (CONF-840734—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014055.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

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With the advent of system concepts to protect against sabotage by an insider, the capability to reliably provide, in a tamper-safe way, information on the state of critical valves is gaining more attention. Several different technological types of valve monitors have been developed and have undergone testing in an operational environment. Some typical designs of monitors, which are based on microswitch, photoelectric, and balanced-magnetic switch techniques, are described, and the test results these monitors recorded are discussed. 4 figures.

37366 **(SAND—84-0538C) Example motion sensor test results using the Sandia intruder motion simulator.** Jones, D.P.; McNerney, G.M.; Sons, R.J. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 5p. (CONF-840734—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014988.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

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Sandia National Laboratories at Albuquerque (SNLA) has designed and built a system to provide repeatability in environmental testing of motion sensors. This system, called Sandia Intruder Motion Simulator (SIMS), is used to acquire much of the data now collected on sensors in this laboratory. This paper reports the results of environmental evaluations performed on several different types of motion sensors using the SIMS. 12 figures.

37367 **(SAND—84-0539C) Motion sensor evaluation using simulation.** Schmutz, J.D.; McNerney, G.M.; Workhoven, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840734—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014989.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

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Thorough evaluation testing of interior motion sensors requires repeated testing under a variety of environmental conditions. Although the sensors are intended primarily for interior installations, many of the buildings where protection may be required are warehouses or bunkers without environmental control. In evaluating sensors for such installations, it becomes important to collect data not only on coverage or sensitivity at room temperature but also at environmental extremes. This paper describes a system Sandia National Laboratories at Albuquerque (SNLA) has designed and built to provide repeatability in environmental testing. The system has been dubbed Sandia Intruder Motion Simulator (SIMS). This system is used to acquire much of the data now collected on sensors in the laboratory and a duplicate system has been delivered to the Belvoir R and D Center so that the laboratory can now run similar tests. 11 figures.

37368 **(SAND—84-1434C) Supporting the material control and accountancy system with physical protection system features.** Miyoshi, D.S.; Olson, C.E.; Caskey, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC05-84OR21400. 21p. (CONF-840734—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014003.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Most physical security functions can be accomplished by a range of alternative features. Careful design can provide comparable levels of security regardless of which option is chosen, albeit with possible differences in cost and efficiency. However, the effectiveness and especially the cost and efficiency of the material control and accounting system may be strongly influenced by the selection of a particular design approach to physical security. In this paper, a series of examples are cited to illustrate the effects that particular physical protection design choices may have. The examples have been chosen from several systems engineering projects at facilities within the DOE nuclear community. These examples are generalized, and a series of design principles are proposed for integrating physical security with material control and accounting by appropriate selection of alternative features. 2 references, 6 figures.

37369 **(UCID—20103) Nuclear Criticality Information System. Database examples.** Foret, C.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014462.

The purpose of this publication is to provide our users with a guide to using the Nuclear Criticality Information System (NCIS). It is comprised of an introduction, an information and resources section, a how-to-use section, and several useful appendices. The main objective of this report is to present a clear picture of the NCIS project and its available resources as well as assisting our users in accessing the database and using the TIS computer to process data. The introduction gives a brief description of the NCIS project, the Technology Information System (TIS), online user information, future plans and lists individuals to contact for additional information about the NCIS project. The information and resources section outlines the NCIS database and describes the resources that are available. The how-to-use section illustrates access to the NCIS database as well as searching datafiles for general or specific data. It also shows how to access and read the NCIS news section as well as connecting to other information centers through the TIS computer.

37370 **Uranium power and horizontal proliferation of nuclear weapons.** Starr, C. (Electric Power Research Inst., Palo Alto, CA). *Science (Washington, D.C.);* **224**: 952-957(1 Jun 1984).

Only a few nonnuclear weapons states with uranium-fueled power plants have kept the weapons option open, and gives evidence of activities intended to divert fissionable material from its civilian system. Analysis of alternative strategies shows that the acquisition of nuclear weapons material would probably depend on military production facilities rather than diversion. Horizontal proliferation is primarily a political issue, and is related only marginally to uranium power development. Restrictions of the Nuclear Non-Proliferation Act on the supply of equipment and fuel by the US appear to have led some nonnuclear weapons states to build small-scale facilities that can be modified for the production of weapons material, however. More attention should be given to the international political, economic, and military factors that persuade such states to forego nuclear weapons. 19 references.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

37371 **(EGG-PBS—6509) Operation manual for the INEL on-line mass-separator facility.** Anderl, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1984. Contract AC07-76ID01570. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015176.

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This report is an operation manual for an on-line mass-separator facility which is located in Building 661 at the Test Reactor Area of the Idaho National Engineering Laboratory. The facility provides mass-separated sources of short-lived fission-product radionuclides whose decay properties can be studied using a variety of nuclear spectroscopic techniques. This facility is unique in that it utilizes the gas-jet technique to transport fission products from a ^{252}Cf source located in a hot cell to the ion source of the mass separator. This document includes the following: (a) a detailed description of the facility, (b) identification of equipment hazards and safety controls, (c) detailed operating procedures for startup, continuous operation and shutdown, (d) operating procedures for the californium hot cell, and (e) an operator's manual for the automated moving tape collector/data acquisition system. 7 references, 16 figures, 8 tables.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 07020038234, 38288, 38289

37372 (INIS-mf—7782, pp 233-235) **Standardization of ^{3}H, ^{14}C and ^{63}Ni radiation sources by calorimetric method.** Khol'nova, E.A.; Kul'kova, L.P. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

The calorimetric method of determination of activity of radionuclides ^{3}H, ^{14}C and ^{63}Ni with low mean energies of β-particles has, as compare to other methods which had been used for determination of activity of these nuclides, a number of advantages, because a nuclide to be measured can be introduced into the calorimeter in any physical and chemical state. It is not necessary to destroy integrity ane leak-proofness of a source wnich can be of arbitrary type. There is no correction for absorption and self-absorption of β-particles and measuring instruments are relatively simple. As a limitation of this method is its low sensitivity which can be overcome

by means of application of modern high sensitivity calorimeters. Such calorimeters have been developed in the Mendeleev All-Union research Institute. The calorimetric installation consists of 3 independent β-calorimeters of differential-double type, working in the regime of heat equilibrium and beeng intended for different by sise and shape sources. Then, there are thermostatting device of special deisghn and electric measuring device. Number of thermocouples in each calorimeter is from 75 to 120 and sensitivity of calorimeters is from $2.45x10^{-7}$ to $4.5x10^{-7}$ Bt/mm depending on the type of calorimeter. Calorimeters are intended for measuring activities from 10^{9} to 10^{12} Bk. Error of measurement of activities equals 0.8-1.5% (with confidence level of 0.99%). The main portion of error consists of error in the medium energy β-spectra. The calorimeter error itself is much more lower. Soueces, which have been measured in the calorimeter than can be used for preparation of solutions and sources of lower activity.

37373 (INIS-mf—7782, pp 293-295) **Modern state of production of radioactivity standards in CMEA member-states.** Lits, Ya.; Latal, F.; Kokta, L. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Review has been given of production of radioactivity standards in the CMEA member-states. The review has been compiled on the base of catalogues from some countries (Czechoslovakia, USSR, Poland, Hungary and Romania) and on the base of information wOich had been obtained in the frameworks of bilateral cooperation with DDR. Problems are discussed of preparation of radioactive solutions, their chemical composition and possibilities of delivery according to the information having been obtained from some producers. Problems are considered of typology of standard sources and possibilities of their application. Special attention has been paid to determination of errors and on comparison of these errors for some types of standards. Comparison has been given of standards, being fabricated in the CMEA member-states with corresponding standards, produced in the capitalist European countries.

37374 (INIS-mf—7782, pp 100-108) **Metrological principles of measurement of activity of radionuclides in Department on standardization, metrology and testing of goods (ASMB).** Brust, R. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Review is given of absolute measuring devices, which compose metrological base for reproduction of units of activity of radionuclides and being used as national standards of the German Democratic Republic. Breef descriptions are given of measuring devices and their main parameters as well as of measuring methods being used. Experience is stated in the field of application of these devices in the frameworks of international comparisons. Description is given of the methods of transmission of demention of the unit of activity of radionuclides from the primary standard to the standards of lower level, which are used.

37375 (INIS-mf—7782, pp 149-155) **Application of β-γ coincidence for determination of radioactive impurities.** Kempisty, T.; Lada, V. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Results have been presented of investigations on application of the β-γ - coincidence method for determination of radioactive impurities in radioisotope preparations. Measurements have been made by means of the quick-slov coincidence circuit of the time-to-amplitude converter type. Scintillation detector with anthracene crystal or Si(Li)-detector was used in the β-channel and scintillation detector of NaJ(Tl) or Ge(Li)-detector w as used in the γ-channel. The following isotope mixtures were studied: ^{169}Yb + ^{170}Tm; ^{137}Cs + ^{13}994Cs and ^{124}Sb + ^{123}Te in which ^{170}Tm, 991^{34}Cs, ^{122}Te isotopes were as impurities. The results of investigations have shown that the method which had been proposed permits to reduce lower minimum limit of radioactive impurities being traced as in compasion to the method of analysis of simple spectrum. In many cases, the method which has been proposed, is the only for identification of impurities.

37376 (INIS-mf—7782, pp 180-187) **Calibration of low-energy β-emitters and β-emitters with transitition on basic level by methods of label and extrapolation of registration efficiency.** Sakhadziya, M. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Results have been stated in the paper of investigations on the problem of absolute calibration of the pure emitter and the β-γ-emitter with transitition to main and metastable levels. During the investigation a mixture of the pure β-emitter plus a label and the β-γ-emitter have been used. Methods of label and extrapolation of effectivity of registration have been used. Correlations have been given which connect effectivity of registration for different types of β-spectra to the optimum region of their variatio·ıs as well as to the results which had been obtained during calibration of radioactive solutions of ^{35}S, ^{147}Pm, ^{99}Mo.

37377 (INIS-mf—7782, pp 188-192) **Metrological provision of measurements by Ge/Li spectrometers during certification of standard sources.** Stepanov, Eh.K.; Danilenko, V.N.; Matveev, S.V. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Results have been given in the paper of analysis of modern state of metrological provision of measurements by means of γ-spectrometers which had been used in certification of standard solutions and radiation sources. Estimations have been given of possibilities for raising precision and rapidity of plotting calibration characteristics of spectrometers by means of radiation sources which contain nuclides having complicated decay schemes. Results have been given of application of the precision γ-spectrometer with Ge(Li) detectors as a standard mean for measurement.

37378 (INIS-mf—7782, pp 198-214) **Working standard of activity unit for α-emitting nuclides.** Gejdel'man, A.M. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Licensing of standard sources and colutions of α-emitting nuclides, in particular of a set of U isotopes and transuranium elements is done in the Khlopin Radium Institute by means of the $4\pi\alpha$-x(γ) coincidence installation. Rational structure of the block of counters has permited to minimize many of components of the systematic error. Metrological parameters of the installatio n have been thoroughly determined. Detailed investigation of factors influencing the results of measurement of activity of nuclides has shown that systematic error durinG routine measurements on the installation is not greater than 0.1-0.2%. This permits to measure activity of α-emitting nuclides with error of 0.2-0.5%, P=0. 99 in solutions with specific activity of 10^{8}-10^{11} Bk/kg and in sources with activity of 10^{3}-$2x10^{4}$ Bk i.e. on the level of the best metrological laboratories. The installation has been licensed by the State Committee of Standardization of the U SSR as the working standard of the unit of activity.

37379 (INIS-mf—7782, pp 225-229) **Metrological provision of measurements of radioactive nuclides activity in radioactive souces and solutions.** Karavaev, F.M.; Kochin, A.E.; Alekseev, V.Ya.; Drichko, A.F.; Sazonova, T.E.; Khol'nova, E.A.; Khol'nov, Yu.V.; Gejdel'man, A.M. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

The state of national standards of radioactivity of radionuclides up to 1979 in the CMEA member-states is given. A list of acting standards of the radioactivity unit and of corresponding installations for measurements is given. Methods are stated of lycensing of calibration radiometric sources by means of standard installations or secondary standards, in particular by means of calibration solutions of radionuclides. Brief description is given of some types of measuring instruments.

37380 (INIS-mf—7782, pp 236-243) **Estimation of radiation parameters of widely used radioactive nuclides.** Khol'nov, Yu.V.; Chechev, V.P. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Analysis and estimation is given of experimental results having been obtained up to 1878 for radionuclides widely used in science, technology and medicine. Ising methods of mathematical statistics, estimation of following nuclear-physical parameters has been made; half-life time; energies and intensities of conversion electrons and Oge electrons; mean energies of these radiations; internal conversion coefficients; ionization γ-constant. Fo r every estimated value of nuclear-physical parameters which had been selected as a result of analysis of experimental data according to the method of estimation, mean veighted or arithmetic mean value have been calculated with an error corresponding to prescribed confidence level. In other case, the result of one of works, considered to be "the best" is taken after analysis.

37381 (INIS-mf—7782, pp 244-248) **Testing of homogeneity and spectral purity of standards of beta-radiation sources by means of semiconductor detection.** Tykva, R. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

New method of inspection of uniformity of area distribution and checking of spectral composition of plain standard sources of β-radiation has been described. Semiconductor scanning installation having special Si-detector was used for detection of radiation. As analogy to autoradiographic installation, this one has received the name of semiconductographic installation. Results have been given of checking some commercially available radiation sources, produced by some of firms of the USA, England, France and Czechoslovakia. The results of this checking have shown co nsiderable imperfection of standards. The reason for this imperfection is mainly in the technology of their fabrication. Compariso n has been made of quality of standards from 4 different manufacture s.

37382 (INIS-mf—7782, pp 249-253) **Determination of small amounts of gamma-emitting impurities in radiation sources of americium-241.** Khudy, M. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Possibilities are studied of determination of small amounts of γ - emitters in the ^{241}Am radiation sources by means of gamma-spectrometry of low activities. This method permits to determine concentrations of γ-emitting impurities on the level of 10^{-7}%. In the ^{241}Am radiation sources which were studied impurities of ^{152}Eu an$\downarrow$ ^{154}Eu have been determined in amounts from $6x10^{-6}$ to $3x10^{-4}$%.

37383 (INIS-mf—7782, pp 254-258) **Standards for measuring of ultra low activities of tritium and carbon-14.** Vesely, K. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Preparation of standards for measurement of very low activities has some peculiarities. Great significance has preparation of background radiation standards. As a main raw material for preparation of background radiation standards used in determination of low activities of tritium, water is used from an artesian well of 1200 m. deep. Water from this well, as in comparison with water samples having been taken from different sources, has the lowest level of signal when measuring tritium content. The age of this water has been determined by the carbon-14 method and equals to nearly 28000 years. Background radiation standards are prepared of this water in the form of distillated water or benzene, containing only non-active hydrogen. These standards have to be used not only for measuring of background radiation but also for delution of radioactive standards. In this manner background radiation standards are prepared for measurement of very low activities of carbon-14 in the form of benzene which is fabricated of coal.

37384 (INIS-mf—7782, pp 259-262) **Some information obtained during determination and identification of radionuclide impurities in standards of radioactive nuclides.** Dryyak, P.; Kokta, L.; Kovarzh, P.; Novotna, P. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

To determine γ-impurities a new spectrometric system produced by Canberra (USA) is used. This system consists of: installation RK05 + RX11 and periphery installations VT50 and LA180. This spectrometric system is operating with Ge(Li) -detectors, having been manufactured in the Nuclear Research Institute, Rzez (Czechoslovakia). Sensitive volume of this detect or equals to 80 cm^3; FWHM = 2.4 keV. Sensitivity limits are estimated for given energy range. Content of impurities in some standards has been checked experimentally. Finally, total is given f or the results having been obtained and methods of automatic estimation of spectra are discussed. Some methods are given automatic analysis of spectra (FFT, methods 1. and 2. of spectra differentiation). Estimation is given of the results having been obtained.

37385 (INIS-mf—7782, pp 269-275) **Instrument limitation of accuracy of absolute measurement by method of 4π beta-gamma coincidence.** Plkh, J. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Accuracy is discussed of determination of coincidence channels dead-time in 4π β-γ installation and determination of coincidence resolution time as well as conditions for determination and accuracy of these parameters. Conditions are considered under which these parameters have not been determined and there is wrong performance of the installation. Special attention was paid to the electronic circuit of the γ-channel. It has been shown that as a result of wrong performance of electronic circuit a new type of wrong coincidence appeared.

37386 (INIS-mf—7782, pp 276-285) **Some problems of absolute measurement of pure β-nuclides by method of label.** Zajts, V.; Plkh, J.; Yasanovski, P. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Dependance of efficiency of nuclide to be measured on efficiency of label has been calculated on the base of theoretical modeling of the process of self-absorption, i.e., it is dependance on ex-

trapolation of the label. These calculations have appeared to be useful for estimation of value of change of label efficiency and on the method of its measurements. It has been shown that linear coefficient of extrapolation curve does not depend on the source of self-absorption but at the same time square-law coefficient has close connection to the self-absorption dispersion and hence to the method of sample preparation.

37387 (INIS-mf—7782, pp 286-292) **Determination of activity of standard solutions of plutonium-239.** Yasanovski, P. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Method has been described of absolute measurement of ^{239}Pu samples of aliquot residues after evaporation of nitrate solutions of Pu. Activity of water-soluble salt of residue is determined by the method of label by means of ^{241}Am. Activity of the non-soluble residue is determined by the relative method of liquid scintillators.

37388 (INIS-mf—7782, pp 296) **Metrological activity of Boris Kigdich Nuclear Research Institute.** Bek-Uzarov, J. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Text of paper to be published separatelly in "Radioizotopy" bulletine.

37389 **(PER—77) Construction of a radiometric calibration facility at Lanseria Airport, Republic of South Africa. Revised report, superseding PER-75.** Corner, B.; Smit, C.J.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Aug 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701538.

The construction of standard sources suitable for the calibration of airborne and truck-mounted gamma-spectrometer systems is described. Four sources were built, three of which were doped with preselected quantities of uranium, thorium or potassium. A fourth source was left barren so as to provide a measure of the background radiation in the area. The sources are 8 m in diameter, 0,35 m thick and are recessed into the disused northern portion of runway 17 at Lanseria Airport, north of Johannesburg. Adopted concentrations of the major radioelements in the sources are: 6,10 % k_2O in the potasssium source, 67,0 ppm U_3O_8 in the uranium source (radiometric), 158 ppm ThO_2 in the thorium source.

37390 **(SAND—84-1400C) Radiation output and dose predictions for flash x-ray sources.** Sanford, T.W.L.; Halbleib, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-840712—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014083.

From 21. IEEE annual conference on nuclear and space radiation effects; Colorado Springs, CO, USA (22 Jul 1984).

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Calculations are made of target parameters required to maximize the photon fluence from flash x-ray sources for electron energies from 0.5 to 15.0 MeV. Doses and effective absorption coefficients for critical materials located downstream of the target are also obtained.

0703 Isotopic Power Supplies

37391 **(DOE/ET/33008—T4) SIG Galileo final converter technical summary report.** Hinderman, J.D. (Minnesota Mining and Mfg. Co., St. Paul (USA). Electrical Products Group). May 1979. Contract AC03-78ET33008. 176p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84014431.

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The report is primarily concerned with the work performed for DOE on converter development and fabrication for the NASA Galileo Jupiter mission as a DOE prime contractor with interface primarily with Teledyne Energy Systems. The activities reported on were directed toward design, analysis and testing of modules and converters SN-1 thru SN-7 and attendant Quality Control and Reliability effort. Although assembly and testing of SN-1 was not accomplished due to the stop work order, the design was virtually completed and a significant amount of subcontracting and manufacturing of both module and converter components was underway. These subcontracting and manufacturing activities were selectively closed down depending upon degree of completion and material or hardware potential usage in the Technology Program.

37392 **(LA—10023) Helium release from radioisotope heat sources.** Peterson, D.E.; Early, J.W.; Starzynski, J.S.; Land, C.C. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015073.

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Diffusion of helium in $^{238}PuO_2$ fuel was characterized as a function of the heating rate and the fuel microstructure. The samples were thermally ramped in an induction furnace and the helium release rates measured with an automated mass spectrometer. The diffusion constants and activation energies were obtained from the data using a simple diffusion model. The release rates of helium were correlated with the fuel microstructure by metallographic examination of fuel samples. The release mechanism consists of four regimes, which are dependent upon the temperature. Initially, the release is controlled by movement of point defects combined with trapping along grain boundaries. This regime is followed by a process dominated by formation and growth of helium bubbles along grain boundaries. The third regime involves volume diffusion controlled by movement of oxygen vacancies. Finally, the release at the highest temperatures follows the diffusion rate of intragranular bubbles. The tendency for helium to be trapped within the grain boundaries diminishes with small grain sizes, slow thermal pulses, and older fuel.

37393 **(LA—10126-PR) Space Nuclear Safety Program. Progress report, November 1983.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015074.

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This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Topics discussed include: safety-verification impact tests; explosion test; fragment test; leaking fueled clads; effects of fresh water and seawater or PuO_2 pellets; and impact tests of 5 watt radioisotope thermoelectric generator.

37394 **(LA—10134-PR) Space Nuclear Space Program. Progress report, December 1983.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015064.

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This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Results from safety-verification tests including impact tests are presented.

08 HYDROGEN

37395 **(NP—4770417) Hydrogen.** (Eidgenoessische Kommission fuer die Gesamtenergiekonzeption, Bern (Switzerland)). 1978. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770417.

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This document consists of two parts, namely: (I) Hydrogen on a Non-Fossil Basis, by B. La Roche; and (II) Possible Scope of Development of a Hydrogen Economy in Switzerland, by R. Minder. A separate abstract was prepared for each part.

0801 Production

REFER ALSO TO CITATION(S) 08010037400, 38074, 38074

37396 **(BMFT-FB-T—84-085) High-temperature electrolysis of steam.** Quandt, K.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751906.

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The first laboratory tests have shown the feasibility of the high-temperature electrolysis of steam. The next aim of the project in Phase II a/b is the construction and start-up of a scaled-up laboratory unit with 1 Nm^3 H_2/h. In addition, the engineering and construction of commercial steam electrolysis units is planned in the present project phase (Phase II a). These investigations are intended to aid in obtaining information regarding which components ought to be installed and tested in a scaled-up laboratory unit (Phase II b). Commercial electrolysis units are designed for various production capacities as well as for the low and medium pressure ranges. For this purpose, process investigations regarding steam/gas routing, construction of electrolysis reactors, utilizing the product gas heat as well as designing of an electrolysis module were concluded. A demonstration HOT ELLY unit for a production of 1.000 Nm^3 H_2/h, 3 bar, was built. The first investment cost estimates have indicated the economics of the process, even as against the conventional hydrogen electrolysis units. In view of the results obtained to date it appears highly promising to press for the commercial application of the high-temperature electrolysis using steam.

37397 **(BNL—34837) Hydrogen production employing high-temperature solid oxide cells.** Maskalick, N.J.; Buzzelli, E.S.; Zuckerbrod, D.; Bonner, M.; Mezzina, A.; Salzano, F. (Westinghouse Electric Corp., Pittsburgh, PA (USA); Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 7p. (CONF-840804—29). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014559.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

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High-temperature (1000°C) solid-oxide cells were employed to electrolyze water vapor. System energy efficiency of 45%, compared to conventional electrolysis at ~ 30% maximum could be possible. Stable levels of resistance and diffusion polarization were observed after approximately 450 hours of continuous testing. Approximately 100% coulombic efficiency was measured. Water vapor dissociation at a nominal 1 volt at > 300 A/sq. ft. can be expected with heat sources near 1000°C. Lower-temperature heat sources may be employed as well, at a commensurately higher voltage. Future planned studies would evaluate design/performance tradeoffs and cost/economic advantages derived from interfacing with various primary resources, such as solar thermal as well as coal conversion systems. 16 references, 5 figures, 3 tables.

37398 (NP—4770417, pp 1-17) **Hydrogen on a non-fossil base.** La Roche, B. 1978. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770417.

In Hydrogen.

Water can be broken down into its components by means of electrolysis or thermolysis. This process requires energy. With electrolysis, this is supplied in the form of electricity, with thermolysis in the form of heat. The energy supplied will be released on oxidation of hydrogen. The resulting oxidation product, again, is water. Losses are small. As soon as the energy cost of fossil energy carriers will rise markedly higher than those of non-fossil ones, transition to a future system employing hydrogen as energy carrier will begin.

37399 **Solar thermal hydrogen production with a direct flux chemical reactor.** Neale, D.H.; Cassanova, R.A. (Georgia Institute of Technology Engineering Experiment Station Atlanta, Georgia). *Alternative Energy Sources;* 575-577(Dec 1983). (CONF-831205—).

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

The generation of fuels and chemicals from commonly available feedstocks using concentrated solar energy is of major importance to the U.S. Department of Energy (DOE) solar thermal research program. In general, chemical reactions yielding these desirable end products must be conducted with significant thermal input at elevated temperatures. Such thermal requirements match well with the potential of point-focusing mirror systems such as the Advanced Components Test Facility (ACTF) operated by the Georgia Institute of Technology for DOE. Accordingly, a program to develop a solar driven chemical reactor has been initiated as one task assigned to the Solar Thermal Advanced Research Center located at Georgia Tech. One particularly interesting concept for converting concentrated solar radiation into chemical bond energy employs the direct flux heated particle entrainment reactor. In this scheme, finely ground solid reactants and/or catalysts are carried in a gaseous reactant flowing through a region of intense flux. In theory, the entrained particulate lends opacity to the flow, absorbs the concentrated incident solar energy, heats and chemically interacts with the surrounding media. For any given reaction this process can be quite complex. Final product composition may depend on such variables as particle surface temperature, gas temperature, heating rate profile, time of particle exposure to radiation (residence time), particle size distribution, presence of catalysts, and spectral distribution of the radiation.

0802 Storage

REFER ALSO TO CITATION(S) 08020037398

0804 Marketing And Economics

37400 (NP—4770417, pp 18-50) **Possible scope of development of a hydrogen economy in Switzerland.** Minder, R. 1978. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770417.

Portions are illegible in microfiche products.

In Hydrogen.

The study deals with the economic aspects of the utilization of hydrogen produced electrolytically by means of nuclear energy, as an energy carrier in Switzerland. The starting point is the idea that hydrogen can be produced at a competitive price as soon as fossil energy carriers have become sufficiently expensive. Two variants of oil price increase are assumed - an "optimistic" one with a real price rise of 50% till the year 2000 and a "pessimistic" one with the doubling till 1985.

0808 Properties

REFER ALSO TO CITATION(S) 08080037398, 37977

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 09011038044

37401 **(CONF-830567—7) Biomass chemicals production by thermochemical conversion.** Klausmeier, W.H. (Argonne National Lab., IL (USA)). 1983. Contract W-31109-ENG-38. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014690.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

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This paper reviews novel concepts for the production of chemicals by the thermochemical conversion of biomass. An engineering and economic analysis builds upon recent laboratory developments to provide a perspective of new process potentials and identifies areas requiring further investigation. Candidate processes fall into two categories: production of acetate esters, vinyl acetate and acetic anhydride by biomass gasification; and production of aromatic chemicals by the hydroprocessing of biomass. Engineering design bases are developed from fundamental data and process economics are then estimated and compared to conventional routes to the same products. The economic evaluation includes systems analysis of how candidate processes can be used within possible integrated facilities. New product applications and the potential for penetration of existing markets are discussed. 13 references, 10 figures, 8 tables.

37402 **(CONF-840111—8) Effective reduction of enteric bacteria and viruses during the anaerobic digestion of biomass and wastes.** Fannin, K.F.; Hsu, P.H.; Mensinger, J.; Cahill, C. (Institute of Gas Technology, Chicago, IL (USA); Gas Research Inst., Chicago, IL (USA)). 1984. 17p. Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616. Order Number TI84901427.

From 8. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (30 Jan 1984).

Natural resource depletion increases the amount of waste requiring efficient and affordable disposal alternatives. Through effective management, many of these so-called wastes can be utilized as important energy and agricultural resources. One such management approach involves the utilization of emergent aquatic plant species, such as water hyacinth, to remove nutrients from the wastewater during growth. This process produces an energy-containing biomass that can then be anaerobically digested either separately or with other waste components to produce energy-containing methane and an effluent residue containing significant quantities of protein and nutrients. This residue can be utilized as an effective fertilizer, soil conditioner, or animal feed supplement provided it is rendered reasonably safe from such contaminants as enteric microorganisms. This study was conducted to identify the digester operating parameters that affect the survival of enteric bacteria and viruses during the anaerobic digestion of blends of water hyacinth and primary sewage sludge. Solids retetion time and temperature were demonstrated to be important parameters affecting the survival of poliovirus, f-2 coliphage, Streptoccus fecalis, and Escherichia coli during anaerobic digestion. The die-off rates of the coliphages were similar to those of the poliovirus at 35°C. S. fecalis appeared to be the most stable of any of the bacteria and viruses studied. All organisms were more stable at 25 than at 35°C. The data demonstrate that the concentration of enteric bacteria and viruses can be effectively reduced during anaerobic digestion using techniques, such as increased solids retention times and mesophilic temperatures, that are consistent with achieving high methane yields. The survival of enteric viruses during anaerobic digestion may be affected by the characteristics of the feedstock as well as by the process operating conditions.

37403 **(DOE/PC/60805—T3) Cation promotion effects in zeolite-supported F-T catalysts.** Goodwin, J.G. Jr.; Sayari, A. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Jun 1984. Contract FG22-83PC60805. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014478.

During this quarter a series of dealuminated NaY zeolites was studied by ESCA. NaY zeolite was dealuminated using an aqueous solution of H_4EDTA. Changes in surface compositions and chemical states as a result of dealumination are reported. ESCA data indicated that aluminum and sodium are preferentially removed from the external surface of the zeolite during dealumination. This is presumably due to diffusional limitations of EDTA molecules into the internal cavities of the zeolite particles. It was found also that the Al/sub 2p/ binding energies of nafaujasite type zeolites are an increasing function of Al/Si ratios of the zeolites. This illustrates the effects of Madelung potential on the chemical states of the framework aluminum atoms. Adsorptive properties of dealuminated and alkali-exchanged zeolite were studied. Adsorption isobars of cyclopropane, cyclohexane and benzene have been performed in the temperature range 25 to 120°C using a TGa system. The results were explained on the basis of variations of void volumes and heat of adsorption as well as chemical interactions. Several runs of CO hydrogenation have been carried out at atmospheric pressure over the following catalysts: 3% Ru/NaY; 1% Ru/20% dealuminated zeolite; 1% Ru/40% dealuminated zeolite; and 1% Ru/60% dealuminated zeolite. The main results and interpretation are presented. 15 references, 5 figures, 1 table.

37404 **(LBL—17789) Mechanisms of Fischer-Tropsch synthesis.** Bell, A.T. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 23p. (CONF-840484—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014608.

From ANS student/professional conference on nuclear science and engineering; College Station, TX, USA (6 Apr 1984).

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Both H_2 and CO in the gas phase are virtually in equilibrium with adsorbed H atoms and CO. The dissociation of CO is on activated process on Ru but is essentially irreversible. The dissociation of CO is on activated process on Ru but is essentially irreversible. The carbon atoms released by CO dissociation react very rapidly via a reversible sequence of steps to form CH/sub x/ (x=1-3) groups. Carbon-carbon bonds appear to be formed via alkyl group migration to methylene groups and insertion of the latter species into the metal-carbon bond of the alkyl. Termination of chain growth can occur by β-hydrogen elimination to form 1-olefins or by reductive elimination to form 1-olefins or by reductive elimination to form normal paraffins. The extension of the proposed scheme to account for the formation of branched hydrocarbons and oxygenated products can readily be envisioned. Branching can result from isomerization of the growing chain. The insertion of CO into the metal-carbon bond of a surface alkyl group will produce an acyl group which is then a precursor to the formation of an aldehyde or alcohol. While the discussion has been limited to Ru, the same chemistry is expected to occur on other Group VIII metals. Consistent with this, several recent studies of Fischer-Tropsch synthesis over Ni, Fe, and Co have proposed equivalent reaction mechanisms. The observed differences in reaction kinetics and product distribution are, therefore, very likely due to differences in the rate and equilibrium parameters associated with individual reaction steps.

37405 **(PB—84-166495) Development of test for determining anaerobic biodegradation potential. Report for Sep 79-Sep 81.** Shelton, D.R.; Tiedje, J.M. (Michigan State Univ., East Lansing (USA). Dept. of Crop and Soil Sciences). Sep 1981. 92p. NTIS, PC A05/MF A01.

This project was for the purpose of developing and evaluating a suitable screening-level laboratory method for the evaluation of the potential that an organic compound might be susceptible to anaerobic biodegradation (methanogenesis) in the environment. As it developed, the project focused on a method under consideration by the American Society for Testing and Materials (ASTM) and the report contains several recommendations as appropriate, for the modification of the draft ASTM method. Overall, the report, with the recommended modifications, consists of a single-lab validation of the basic method. The method also appears as one of the EPA Office of Toxic Substances Chemical Fate Test Guidelines. In the method, a chemically defined anaerobic medium containing resazurin, as an oxidation/reduction indicator, and 10 primary anaerobic digestor sludge are dispensed in 100-mL portions into serum bottles. Selected bottles are supplemented with test substance at a concentration equivalent to 50 mg/L as organic carbon. Gas production is measured at appropriate intervals. The extent of biodegradation is determined by comparing gas production from blank control bottles and bottles containing the test substance.

37406 **Hydrogenation of ethylene over platinum (111) single-crystal surfaces.** Zaera, F.; Somorjai, G.A. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **106**: No. 8, 2288-2293(18 Apr 1984). Contract AC03-76SF00098.

The hydrogenation of ethylene with both hydrogen and deuterium was studied over (111) platinum single-crystal surfaces under a total pressure of 110 torr and a temperature range of 300-370 K. An activation energy (E/sub a/) of 10.8 +/- 0.1 kcal/mol and ki-

netic orders with respect to hydrogen and ethylene partial pressure of 1.31 +/- 0.05 and -0.60 +/- 0.05, respectively, were observed. The deuterium atom distribution in the product from the reaction with D_2 peaks at 1-2 deuterium atoms per ethane molecule produced, similar to what has been reported for supported catalysts. The reaction takes place on a partially ordered carbon covered surface, where the carbonaceous deposits have a morphology similar to that of ethylidyne. However, this ethylidyne does not directly participate in the hydrogenation of ethylene, since both its hydrogenation and its deuterium exchange are much slower than the ethane production. A mechanism is proposed to explain the experimental results.

37407 **Molecular weight distribution of the heavy wax fraction from Fischer-Tropsch synthesis.** Stenger, H.G.; Johnson, H.E.; Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge). *Journal of Catalysis;* **86**: No. 2, 477-480(Apr 1984). Contract FG22-81PC40771.

Little reliable information is available on the carbon-number distribution of Fischer-Tropsch products above approximately C_{30}. This article reports on the analysis of the reactor waxes remaining in the liquid phase after several lengthy slurry reactor studies. The analyses were done by high-temperature gas chromatography and gel permeation chromatography. The catalysts were a reduced fused magnetite and a precipitated iron oxide promoted with potassium and copper.

37408 **Evidence for alkyl intermediates during Fischer-Tropsch synthesis and their relation to hydrocarbon products.** Wang, C.J.; Ekerdt, J.G. (Univ. of Texas, Austin). *Journal of Catalysis;* **86**: No. 2, 239-244(Apr 1984).

Fisher-Tropsch synthesis mechanisms have been postulated in which alkyl fragments are both the chain-growing intermediate and the precursor to hydrocarbon products. The conversion of CO/H_2 into small alkyl fragments was investigated by scavenging C_1-C_3 alkyl species from the surface of an iron catalyst during Fischer-Tropsch synthesis. The experiments were performed in a steady-state mode revealing that pyridine did not inhibit or poison the Fischer-Tropsch reaction, rather it suppressed the overall rate slightly. Scavenged α-alkylpyridine distributions were dependent upon synthesis variables and displayed a dependence which was proportional to the dependence upon synthesis variables and displayed a dependence which was proportional to the dependence of C_1-C_3 Fischer-Tropsch products. These dependences are used to demonstrate that alkyl fragments are the immediate precursors to Fischer-Tropsch products.

37409 **Electron density and bond polarization effects in reactions of energetic carbon-11 leading to acetylene.** Lambrecht, R.M.; Wolf, A.P. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **88**: No. 4, 720-723(16 Feb 1984).

Evidence is presented indicating that reactions of energetic carbon-11 are effected by the presence and type of halogen in gas-phase methyl halides. Correlations of acetylene-^{11}C yields with ^{1}H and ^{19}F NMR chemical shifts of the substrates indicate that electron density and bond polarization factors influence the mechanism(s) leading to hot products such as $(^{11})C_2H_3$. $(^{11})C_2H_3$ was formed primarily by an intramolecular mechanism in methyl chloride.

37410 **Fermentation in a fluidized-bed reactor.** Scott, C.D. (Oak Ridge National Lab., TN). *Chemical Technology;* **13**: 364-365(Jun 1983).

A laboratory-scale fluidized-bed bioreactor system for the production of ethanol from a glucose solution using flocculating Zymomonas mobilis was studied. Although the results are preliminary, 2.5- to 3.8-cm-diameter systems were operated for more than 300 h using fluidized floc particles that are 1-2 mm in diameter. The ethanol production rate in the lower portion of the fluidized bed operating at 30°C routinely exceeded 200 g/L x h and under some conditions was as high as 400 g/ L x h with a reactor residence time of a few minutes. This far surpasses the results obtained with a batch, stirred-tank reactor using yeast. Ethanol productivity based on the total reactor volume approached 100 g/L x h, and glucose conversion exceeded 95%. With continued research, even higher production rates will be possible as conditions are optimized and scale-up to larger systems will allow the establishment of technical feasibility.

37411 **CO chemisorption and H_2/D_2 isotope effect on the CO hydrogenation reaction on Ni(111) and Ni/TiO_2 (100).** Kao, C.C.; Tsai, S.C.; Chung, Y.W. (Northwestern Univ., Evanston, IL). pp 211-218 of Metal-support and metal-additive effects in catalysis. Imelik, B. (ed.). Amsterdam, Netherlands; Elsevier Scientific Publishing Co. (1982). Contract AC02-78ER04946.

A TiO_2 (100) single crystal surface covered with 5A Ni was used as a model supported catalyst to study effects of strong metal-support interaction (SMSI) on CO chemisorption and the CO hydrogenation reaction. Auger and C ls peak height measurements showed that CO chemisorption on Ni/TiO_2 (100) is suppressed by 2.5 times compared to that on Ni(111). In situ CO hydrogenation studies showed that the specific methanation activity from 5A Ni/TiO_2 (100) is ~3.0-3.5 times that from Ni(111). No H_2/D_2 isotope effect was found for methane production on both Ni(111) and Ni/TiO_2 (100), while the higher molecular weight product formation showed an inverse isotope effect on Ni (111) and a normal isotope effect on Ni/TiO_2 (100). A qualitative explanation was proposed to account for the SMSI and the isotope effects. 20 references, 6 figures.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 09022037401

37412 **(DOE/AF/20004—T1) Enzyme conversion of biomass to fermentable sugars.** Bagby, M.O. (comp.). (Agricultural Research Service, Peoria, IL (USA). Northern Regional Research Center). 1983. Contract AI01-81AF20004. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84010856.

Saccharification studies indicated the suitability of Trichoderma viride 253 crude enzyme preparation as a promising agent for saccharifying sugarcane baggase hemicellulose, treated α-cellulose, and alkali-treated bagasse. Utilization of sugarcane bagasse for the fermentative production of cellulases, hemicellulases, and single cell protein (SCP) by T. viride 253 can be outlined as follows: (a) Production of extracellular cellulases and hemicellulases in a forced aeration-stirred tank fermentor using crude bagasse as the sole carbon source in Dox's culture medium. (b) Treatment of the remaining biodegraded bagasse with NaOH. (c) Refermentation in static culture of bagasse as the sole carbon source in Dox's culture medium for production of SCP material. The yeast, Pachysolen tannophilus, is capable of converting xylose and glucose to ethanol. Fermentation of the crude hydrolyzate from straw revealed low efficiencies of 40 to 60%. As anticipated, interfering substances are present in these crude substrates. Further procedures for optimization of both processing of hydrolyzates and fermentation are being investigated. Endoglucanase and cellobiase are inhibited by glucose, and cellobiose inhibits exoglucanase. A yeast (Candida wickerhamii) was isolated which ferments water soluble oligosaccharides. Because oligosaccharides (cellulodxtrins) are easier to prepare than glucose from cellulose, attention has been directed toward substrate preparation and organism characterization. While the literature contains several methods for preparing cellulodextrins, all the methods involve several steps or involve the removal or neutralization of strong acids. A simple method has been developed using trifluoroacetic acid (TFA)-water for the hydrolysis. Analysis by TLC and HPLC shows a series of cellulodextrins (DP1-6) which are completely converted to ethanol by Candida wickerhamii in 4 to 5 days.

37413 **(DOE/AF/20004—T2) Measurement of permeation of membranes by ethanol and water with integrated optics and Raman spectroscopy.** Scherer, J.R.; Bailey, G.F.; Malladi, D.P. (Department of Agriculture, Washington, DC (USA)). 25 Mar 1983. Contract AI01-81AF20004. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010855.

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A new method for measuring the permeability of synthetic membranes to water and ethanol has been developed. The technique involves using the membrane as a laser waveguide and making Raman scattering measurements from the guided laser beam. The measurements show that alcohol can be detected at low levels within damp cellulose acetate membranes. The results suggest that further exploration using waveguide and Raman measurements might lead to a better understanding of the mechanisms which affect the relative permeability of alcohol and water. 6 references, 4 figures, 1 table.

37414 **(DOE/ER/05226—2) Study of catalysts and mechanisms in synthesis reactions. Progress report.** Lunsford, J.H. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). 1984. Contract AS05-76ER05226. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015025.

This research program may be broadly divided into two categories: alcohol synthesis over supported metals and the generation of gas phase radicals at surfaces of catalytic interest. The goal of the research on alcohol synthesis has been to understand the origin of the large differences in activity of palladium which have been observed when the support is varied or when alkali metal ions are added to the catalyst. The objective of the research on radical formation is to identify surface sites and reaction conditions which are favorable for the production of specific gas phase radicals.

37415 **(DOE/FE/16122—1491-Vol.4) Keystone feasibility study. Final report. Vol. 4.** (Westinghouse Electric Corp., Madison, PA (USA). Synthetic Fuels Div.). Dec 1982. Contract FG01-81FE16122. 233p. NTIS, PC A11/MF A01. Order Number DE84002544.

Volume four of the Keystone coal-to-methanol project includes the following: (1) project management; (2) economic and financial analyses; (3) market analysis; (4) process licensing and agreements; and (5) appendices. 24 figures, 27 tables.

37416 **(DOE/ID/12051—T2) Kinetics of hemicellulose autohydrolysis for wheat straw.** Murphy, V.G.; Linden, J.C.; Moreira, A.R. (Colorado State Univ., Fort Collins (USA). Dept. of Agricultural and Chemical Engineering). Nov 1982. Contract AS07-79ID12051. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84014792.

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Hemicellulose and nonstructural carbohydrates, such as fructosans, can be removed from the fiber complex of wheat straw during a pretreatment process called autohydrolysis. The autohydrolysis process for wheat straw was modeled as a series of first order reactions from polymer to oligomer, to monomer and finally to degradation products. The rate equations derived from mass balances for this series of first order reactions were integrated to obtain time and temperature dependent expressions for the concentrations of the several species involved in the process. The rate limiting step in xylose monomer production was found to be the conversion of oligomer to monomer. The addition of $Al_2(SO_4)_3$ was found to increase this rate of conversion. Several isothermal autohydrolysis runs were conducted on fructosan-free wheat straw over the temperature range of 140 to 170°C to obtain xylose oligomer and monomer profiles as a function of time in distilled water and in a 0.2 wt % $Al_2(SO_4)_3$ solution. The 0.2 wt % $Al_2(SO_4)_3$ solution was determined to be an approximation of the optimum dosage for maximum sugar recovery. The values of the rate constants associated with the formation of xylose were estimated by a simplex search of an objective function. Activation energies and frequency factors were estimated for each rate constant from Arrhenius-type plots of ln K vs 1/T. From these studies, the optimum process for sugar recovery during wheat straw autohydrolysis is envisioned as occurring in two steps. First, fructosan is extracted at 120°C for 35 minutes. Next, the fructosan-free straw is autohydrolyzed at a higher temperature. The two operating options for the autohydrolysis reactor to obtain maximum monomer recovery are: (a) 155°C for 50 minutes in 0.2 wt % $Al_2(SO_4)_3$; and (b) 170°C for 120 minutes in distilled water for the temperature range tested (155 to 170°C). 50 references, 23 figures, 17 tables.

37417 **(DOE/ID/12051—T3) Development of a geothermally assisted process for the production of liquid fuels and chemicals from pinewood. Executive summary of Final report.** Murphy, V.G.; Linden, J.C. (Colorado State Univ., Fort Collins (USA). Dept. of Agricultural and Chemical Engineering). Jan 1983. Contract AS07-79ID12051. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014793.

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The primary goal of the work discussed in this report was to investigate the extent to which pinewood could be converted to fermentable sugars using geothermal hot water to enhance conversion of lignocellulosic biomass to ethanol. The delignification process is a synthesis of two recently developed pulping processes. In the first step, called autohydrolysis, hot water is used directly to solubilize hemicellulose and to depolymerize lignin. Then, in a second step known as organosolv pulping, the autohydrolyzed material is extracted with aqueous alcohol. The autohydrolysis conditions that permitted the maximum recovery of the sugars produced by the chemical hydrolysis of the hemicellulosic component were determined. Next, using material subjected to autohydrolysis under these conditions, we made a thorough study of the effects of variations in the organosolv extraction procedure on the yield of sugar in the subsequent enzymatic hydrolysis of the cellulosic component. In this work, we were guided by a desire to maximize the yield of sugar and to minimize the use of solvent. The latter constraint arose due to the cost that would be involved in reconcentrating (by distillation) large amounts of diluted aqueous alcohol. Once optimal (or near optimal) pretreatment conditions were determined, we made a study of the effects of two major parameters, substrate concentration and enzyme/substrate ratio, on the sugar yield from enzymatic hydrolysis of optimally pretreated wood. In related experiments we characterized the efficiency with which these sugars could be fermented to ethanol. 14 references, 8 figures, 4 tables.

37418 **(DOE/PETC/QTR—84/2) Quarterly technical progress report, period ending March 31, 1984.** (USDOE Pittsburgh Energy Technology Center, PA). Jul 1984. 125p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84015151.

After some system contamination problems encountered during shakedown testing, the Liquid Phase Methanol Process Development Unit in LaPorte, Texas, is now fully operational under design conditions. TRW has completed fabrication of the test loop that will be used to evaluate plant equipment selection and performance using coal-water mixtures. In the area of flue gas cleanup, our two large E-Beam projects have both reached significant milestones. A Coal Technology Laboratory has been established at the site of the former Carbondale Mining Technology Center. The technical program under this agreement includes eleven research projects in the areas of coal science and coal preparation, conversion, and utilization. A refined flow scheme for the fused-salt or Gravimelt process showed that countercurrent extraction can produce a coal that when burned would produce only 0.8 pounds of SO_2 per million Btu's, in compliance with New Source Performance Standards for Pittsburgh coal. The Combustion Test Facility at PETC was used for a number of interesting tests this quarter. Analysis of coal-water mixture combustion tests in PETC's 700-horsepower boiler indicate that the use of oxygen-enriched combustion air can result in higher carbon conversion and boiler efficiencies.

37419 **(DOE/R8/07012—T1) Performance report on construction and operation of a demonstration/educational/operating small-scale alcohol plant.** (North Dakota State School of Science, Wahpeton (USA)). 30 Apr 1981. Contract FG48-80R807012. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015416.

The North Dakota State School of Science has successfully built and operated a demonstration/educational/operating small-scale alcohol plant. The college purchased and provided the equipment, provided for teachers and supervision, and developed the curriculum for the workshops. Further purpose of the grant was to establish a center to train and educate farmers and others to safely produce and use alcohol fuels; to assist in developing the decision-making tools needed to engage in production; and to provide tech-

nical assistance and consumer protection information. Participants were taught how to design and build their own plants and how to process crops into alcohol and other valuable by-products. Participants observed the demonstration small-scale plant and watched alcohol being made. Laboratory experiences included cooking and fermenting crops, distilling, plant design and engine modification to utilize the alcohol. Discussions were held on the nutritional value of the wet mash, economics, markets and uses of bi-products and legal and financing concerns.

37420 **Ethanol from whey: continuous fermentation with cell recycle.** Janssens, J.H.; Bernard, A.; Bailey, R.B. (Solar Energy Research Inst., Golden, Colorado). *Biotechnology and Bioengineering;* **26**: No. 1, 1-5(1984).

The production of ethanol from cheese whey lactose has been demonstrated using a single-stage continuous culture fermentation with 100% cell recycle. In a two-step process, an aerobic fed batch operation was used initially to allow biomass buildup in the absence of inhibitory ethanol concentrations. In the anaerobic ethanol-producing second step, a strain of Kluyveromyces fragilis selected on the basis of batch fermentation data had a maximum productivity of 7.1 g ethanol/L/h at a dilution rate of 0.15 h^{-1}, while achieving the goal of zero residual sugar concentration. The fermentation productivity diminished when the feed sugar concentration exceeded 120 g/L despite the inclusion of a lipid mixture previous shown to enhance batch fermentation productivities.

37421 **Chemicals from biomass.** Sheppard, W.J.; Lipinsky, E.S. (Battelle Columbus Lab., Columbus, OH). pp 635-658 of Biomass utilization. Cote, W.A. (ed.). New York, NY; Plenum Press (1983). (CONF-8209230—).

From NATO Advanced Study Institute on biomass utilization; Alcabideche, Portugal (26 Sep 1982).

An overview is presented of the use of biomass as a source of materials. Prices of biomass materials have fallen relative to petroleum, making biomass a much more attractive feedstock for chemicals than it was twenty years ago. In the United States fermentation ethanol recently has become cheaper than synthetic ethanol, while products from lignocellulose are becoming more competitive and may take over many specialty resin markets now served by phenol. The pros and cons for the production of ethanol, lactic acid and acetic acid from biomass are discussed.

0904 Solid Waste And Wood Fuels

37422 **(PB—84-186352) Study on availability and demand for wood residues in respect of potential development trends. Special report.** Sorfa, P. (National Timber Research Inst., Pretoria (South Africa)). Mar 1983. 33p. NTIS, PC E04/MF E01.

Availability of and demand for wood residues were analyzed for the period 1980 to 1990. The analysis included the majority of residues generated by wood processing industries, as well as forest residues. The available data indicate that the demand for residues will increase dramatically by 1985 and the availability of residues will rapidly diminish. The use of wood residues as fuel may become a wasteful practice in future, and the residues will rather be converted into merchantable products. The conversion of sawmills into integrated wood processing plants may become a very strong trend.

37423 **Phenotypic variation in calorific value of melaleuca materials from South Florida.** Wang; S.; Littell, R.C. (Univ. of Florida, Gainesville). *Economic Botany;* **37**: No. 3, 292-298(Jul-Sep 1983).

Phenotypic variation in calorific value among melaleuca samples from natural stands in South Florida is described. One hundred trees were selected from ten 5 m x 5 m test plots distributed evenly in 2 geographic areas - Lee County and Dade County. In general, no geographic changes in calorific value, for either wood and bark, were evident. Differences among the plot averages were significant. Both calorific values of wood and bark fluctuated greatly among trees within plots. The calorific value did not seem to relate with the size of tree. Implications for tree improvement are discussed.

13 HYDRO ENERGY

1303 Plant Design And Operation

37424 **(EPRI-EM—3534-Vol.1) Cost and design study of modular small hydro plants. Volume 1. Cost and design study. Final report.** Pereira, L. (Acres American, Inc., Buffalo, NY). Jun 1984. 147p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920457.

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The background to the study, the study's objectives, and the basic concept and features of a pump-as-turbine (PAT) installation are described. The PATs, induction generators, and speed increasers are described. The principal selection, design considerations, and features are stressed and a comparison made with the type of equipment used in conventional hydroelectric developments. The control and protection systems, transformers, switchgear, gates, valves, and mechanical services equipment are discussed in a similar vein. Data are given which will enable preliminary equipment estimates to be prepared for a PAT facility. Siphon penstock application is addressed and layouts and costs are given for a typical scheme. The feasibility of prefabricating the powerhouse substructure and switchgear is discussed. The influence of the major items of mechanical and electrical equipment is discussed on an individual and overall basis. The site selection process and analyses of the selected sites are described and the principal findings about PAT installations are presented. The reasons for choosing the four sites for detailed case studies are given. The detailed investigations of the four sites and selection of the two sites for field tests are described. The purpose of the tests, the proposed work program, and project data for the two sites are presented. The method and results of the survey, which assesses the number and location of potential PAT sites, are given.

37425 **(EPRI-EM—3534-Vol.2) Cost and design study of modular small hydro plants. Volume 2. Appendixes. Final report.** Pereira, L. (Acres American, Inc., Buffalo, NY). Jun 1984. 255p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920434.

The following appendices are included: major mechanical equipment and auxiliary electrical equipment for pumps as turbines (PAT), siphon penstock, prefabricated powerhouse, reliability of PAT installations, representative site investigation data, and case studies of four sites. (MHR)

37426 **(EPRI-EM—3534-Vol.4) Cost and design study of modular small hydro plants. Volume 4. Siphon penstock model test report. Final report.** Pereira, L. (Acres American, Inc., Buffalo, NY). Jun 1984. 88p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920431.

A small hydro plant with a penstock and pump-as-turbine (PAT) unit was constructed and tested in the laboratory to evaluate the performance of the model under certain operating conditions and obtain information which may be used in the design of a prototype hydro plant. The tests performed on the model included normal start-up, steady run and shutdown operations, vacuum filling tests, a study of air bubble behavior, and surging observed in the intake leg of the siphon. Tests were repeated for a second configuration with an exaggerated siphon lift, but with the same head. In both configurations, plant operations were investigated with the butterfly valve open and closed. The simulation with the valve open was of particular interest because of the potential economies of a prototype without a valve.

1305 Economics And Management

37427 **(AD-A—140262/7) Feasibility report for hydropower, St. Anthony Falls locks and dams, Mississippi River, Minneapolis, Minnesota. Final report.** (Corps of Engineers, St. Paul, MN (USA). St. Paul District). Feb 1984. 523p. NTIS, PC A22/MF A01.

Supersedes AD-A129708. Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

This report presents a more detailed evaluation of the additional hydropower potential at both Upper and Lower St. Anthony Falls. An earlier evaluation in a reconnaissance level report dated September 1981 showed preliminary feasibility for added hydropower development at both locations. There are existing hydropower development at both locations. There are existing hydropower plants at each location that are owned and operated by Northern States Power Company. The existing units generate at nameplate capacities of 12.4 MW (megawatts) at Hennepin Island (Upper St. Anthony Falls) and 8.0 MW at Lower Dam (Lower St. Anthony Falls). This study was conducted assuming Federal development of additional hydropower at St. Anthony Falls. Project cost data, economic parameters, and other information would be different when assuming development by the present hydropower license, Northern States Power Company. This study concludes that added hydroelectric capacities of 21.0 MW at Upper St. Anthony Falls and 5.4 MW at Lower St. Anthony Falls are the optimum amounts that could be added at these two sites. The upper and lower sites would produce additional average annual energy of 65,120 and 18,900 MWh (megawatt-hours), respectively. The added energy developed from these two sites would be equivalent to 143,000 barrels of oil or 39,000 tons of coal per year.

37428 **(EPRI-EM—3534-Vol.3) Cost and design study of modular small hydro plants. Volume 3. Application manual. Final report.** Pereira, L. (Acres American, Inc., Buffalo, NY). Jun 1984. 99p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920429.

The application manual describes the methods and procedures used in conducting a prefeasibility study for a small hydro installation. The results from the study can then be used to decide whether to proceed with the project and initiate the preliminary engineering and licensing procedures. The manual addresses itself in particular to projects where it is proposed to use a pump-as-turbine (PAT) as the prime mover rather than a conventional turbine-generator. References are given which describe the details to be followed for a conventional unit. The limitations, possible layouts, and method of developing the cost estimates for siphon penstocks if they can be applied at the site are detailed. A guide procurement specification which may be used for the contract for the supply and installation of the turbine, generator, and auxiliary electrical equipment is included.

1307 Power Conversion Systems

REFER ALSO TO CITATION(S) 13070037426

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 14000037916

37429 **(DOE/SF/11972—T1) Development of a strategic technology transfer plan for DOE's active heating and cooling division. Final report.** (Chen (WT) and Co., Inc., Stow, MA (USA)). Apr 1984. Contract AC03-83SF11972. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013653.

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The technology transfer objectives of the U.S. Department of Energy's Active Heating and Cooling Division (AHCD) are to quickly and effectively disseminate as well as improve access to the results from its solar R and D projects to its user markets. A study was undertaken to determine whether or not any of the information products and services of the technical and scientific publishing, online database, interactive videodisk, and technical conferences/trade show industries could be used to achieve those objectives. Presented in this report are discussions of the approach used, results, and recommended technology transfer plan to achieve AHCD's technology transfer objective. Part I of this report focuses on the study itself. Part II describes the details of the technology transfer plan.

1401 Resources And Availability

37430 **(NMERDI—2-67-2430) Solar energy resource assessment in eastern New Mexico and solar and wind energy resource assessment in eastern New Mexico. Final report, July 1, 1978-December 31, 1983.** Sittler, O.D.; Agogino, M.M. (Eastern New Mexico Univ., Portales (USA)). Jun 1984. 29p. (NMERDI—2-68-2421). NTIS, PC A03/MF A01. Order Number DE84901511.

Solar insolation data collected by the pyranometer station established at Eastern New Mexico University with funds from a previous New Mexico Energy Research and Development Institute grant have been recorded and analyzed. Operation of the station, methods of data analysis, and the development of a micro-processor recording system to automate data analysis of solar and wind energy data are described. Daily and monthly solar radiation averages from the old instrumentation are presented for the period October, 1978 through December, 1979 and those from the new instrumentation from January, 1982 through December, 1983.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 14050037401, 37402, 37405, 37410, 37412, 37413, 37416, 37417, 37419, 37420, 37421, 37422, 37423, 38007, 38045, 38076, 38077, 38085, 38399, 38499, 38638

37431 **(BMFT-FB-T—84-065) Physico-chemical studies on copper sulfide in view of its behaviour in the CdS-Cu_2S solar cell.** Rickert, H.; Wiemhoefer, H.D.; Filthaut, C. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 74p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751902.

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The purpose of this research-project was to carry out physico-chemical investigations on copper sulfide which are of interest concerning the behaviour of Cu_2S in CdS/Cu_2S-solar cells. Therefore an electrochemical technique was developed using metal-copper sulfide-point contacts, which allowed investigations on the transport properties and voltage limits for the electrochemical decomposition of copper sulfide which is important in estimating the degradation processes in the Cu_2S of CdS/Cu_2S-solar cells. A model for the electrochemical treatment of the metal-copper sulfide-point contacts was developed and discussed. The current-voltage behaviour of metal-Cusub(x)S contacts was extensively investigated using metal-tips of gold, nickel, platinum, silver, copper and zinc. The deposition of copper in Cusub(x)S occurs at critical voltages which are up to 250 mV higher than expected from thermodynamic data. Furthermore electrical conductivities of copper sulfide (pressed pellets) were measured for compositions between Cusub(2.000)S and Cusub(1.994)S. The electrical conductivity, the concentration and mobility of holes, was determined on thin Cusub(x)S-films (0,15 - 1,5 μm) with stoichiometries between Cusub(2.000)S and Cusub(1.98)S. Chemical diffusion coefficients of copper in Cusub(x)S were measured for temperatures between 20°C and 80°C and the partial conductivity of copper-ions was calculated from these results. Finally the kinetics of the electrochemical decomposition of copper sulfide to copper was investigated in detail.

37432 **(DOE/CE/30784—T1) Energy wood harvesting technology: a review of the state of the art.** McKenna, R. (Meridian Corp., Falls Church, VA (USA)). May 1984. Contract AC01-83CE30784. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014428.

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This report summarizes information obtained from the literature to provide a review of recent developments and evolving concepts in the technology of harvesting wood for use as an energy feedstock. Discussion centers on a variety of innovative prototype machines designed to recover or harvest above ground tree biomass from existing forests, as well as short-rotation intensively cultured plantations. Conventional forest harvesting equipment is addressed in a generic sense, and some broad economic considerations of

energy wood harvesting and utilization are examined. 49 references, 26 figures, 7 tables.

37433 **(DOE/ER/10538—3) FMN photosystem I solar cell. Final report, September 1, 1979-October 31, 1982.** Gross, E. (Ohio State Univ. Research Foundation, Columbus (USA). Dept. of Biochemistry). Jun 1984. Contract FG02-79ER10538. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013701.

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A solar cell is described which uses a combination of photosynthesis electron transport and the photochemical reduction of flavin mononucleotide (FMN). A maximum power of 20 mW, a maximum power efficiency of 0.02%, and a resistance at maximum power of 3500 ohms were obtained. Other dyes can be substituted for FMN as electron acceptors for the solar battery. (DMC)

37434 **(DOE/ER/10873—T1) Detailed progress report, April 1, 1981-May 30, 1984.** (Illinois Univ., Urbana (USA)). 1984. Contract AC02-81ER10873. 6p. NTIS, PC A02; 3; GPO Dep. Order Number DE84014620.

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Research progress is reported in the following areas: (1) establishment of strains of obligate proton-reducing acetogens in a recognized culture collection; (2) long-chain fatty acid degrading syntroph bacteria cultures; (3) benzenoid compound degrading bacteria; and (4) co-using species. (ACR)

37435 **(DOE/ET/23034—T4) Amorphous Si solar cells. Final report, January 1, 1979-February 1, 1980.** Dalal, V.L. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). 14 Feb 1980. Contract AC03-79ET23034. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84010338.

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The object of the work reported was to start an integrated material-to-device program to study the efficiency limits of a-Si and to correlate the device properties with the material properties and material growth. Plasma-deposition techniques have been developed, and fluorinated films have been grown from SiF_4:H_2 mixtures. Growth of a-SiO/sub x/:H alloys has been started to produce films with large bandgaps. Material properties studied include bandgap, state density, photo-induced change in conductivity, and transport properties. Junction devices have been fabricated and studied. A detailed device analysis model which accounts for the distributed nature of gap-state densities has been developed and used. Design goals have been set. (LEW)

37436 **(DOE/JPL—1012-96) Review of the silicon material task.** Lutwack, R. (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Feb 1984. Contract AI01-76ET20356. 42p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014599.

The Silicon Material Task of the Flat-Plate Solar Array Project was assigned the objective of developing the technology for low-cost processes for producing polysilicon suitable for terrestrial solar-cell applications. The Task program comprised sections for process developments for semiconductor-grade and solar-cell-grade products. To provide information for deciding upon process designs, extensive investigations of the effects of impurities on material properties and the performance of cells were conducted. The silane process of the Union Carbide Corporation was carried through several stages of technical and engineering development; a pilot plant was the culmination of this effort. The work to establish silane fluidized-bed technology for a low-cost process is continuing. The advantages of the use of dichlorosilane in a Siemens-type process were shown by Hemlock Semiconductor Corporation. The development of other processes is described.

37437 **(DOE/JPL—1012-97) Photovoltaic module encapsulation design and materials selection. Volume II.** Cuddihy, E. (Jet Propulsion Lab., Pasadena CA (USA)). 1 Jun 1984. Contract AI01-76ET20356. 107p. (JPL-PUB—84-34). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014963.

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This is Volume II of Photovoltaic Module Encapsulation Design and Materials Selection: a periodically updated handbook of encapsulation technology, developed with the support of the Flat-Plate Solar Array Project (FSA), managed for the Department of Energy (DOE) by the Jet Propulsion Laboratory. Volume II describes FSA encapsulation technology developed between June 1, 1982, and January 1, 1984. Emphasis during this period shifted from materials development to demonstration of reliability and durability in an outdoor environment; the updated information in this volume reflects the developing technology base related to both reliability and encapsulation process improvements.

37438 **(DOE/JPL/956312—07) Stress studies in EFG. Quarterly progress report, January 1, 1984-March 31, 1984.** Kalejs, J.P. (Mobil Tyco Solar Energy Corp., Waltham, MA (USA)). 15 Jul 1984. Contract NAS-7-100-956312. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84015260.

Four-point bending studies have been continued to compare primary creep response of FZ and CZ silicon above 1200°C. Results suggest that silicon can be treated as a completely plastic solid in the temperature range 1200 to 1400°C in its response to thermal stress generated during sheet growth. In the stress range of 5 to 15 MPa, the strain rate dependence on stress is $\epsilon \sim \sigma^{10}$, and appears to be essentially temperature independent. Work is underway to compare stresses predicted for two different thermal models used for temperature field calculations. Stress analysis has been performed to illustrate the dependence of sheet stresses on growth parameters such as sheet width, thickness and growth speed, and the coupling of these parameters to the details of the temperature field calculations used as input to the stress model. The construction of a simplified EFG ribbon system to be used to test the stress model and to investigate means to achieve low stress growth configurations is completed. The first results of measurement of residual stress distributions in EFG sheet using shadow-Moire interferometry have been obtained at the University of Illinois.

37439 **(DOE/JPL/956369—84/03) Microcrystalline silicon growth for heterojunction solar cells. Final report, November 1982-January 1984.** Leung, D.C.; Iles, P.A.; Fang, P.H. (Applied Solar Energy Corp., City of Industry, CA (USA); Boston Coll., Chestnut Hill, MA (USA)). Feb 1984. Contract NAS-7-100-956369. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013757.

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Microcrystalline Si (m-Si) films with a 1.7eV energy bandgap and crystal size of several hundred A were e-beam evaporated on single crystalline Si (c-Si) to form a heterojunction with the substrate, or a window layer to a single crystalline p-n junction (heteroface structure). The goal was to enhance Voc by such uses of the larger bandgap m-Si, with the intriguing prospect of forming heterostructures with exact lattice match on each layer. It was found that the heterojunction structure was affected by interface and shunting problems and the best Voc achieved was only 482mV, well below that of single crystal Si homojunctions. The heteroface structure showed promise for some of the samples with p m-Si/p-n structure (the complementary structure did not show any improvement). Although several runs with different deposition conditions were run, the results were inconsistent. Any Voc enhancement obtained was too small to compensate for the current loss due to the extra absorption and poor carrier transport properties of the m-Si film. A study of the m-Si/c-Si interface using a p-p or n-n heterojunction showed that m-Si did not always serve as a minority carrier barrier as expected. The Voc in many samples was of opposite polarity from that predicted which indicated some degree of carrier collection. This raised problems concerning the nature of the m-Si/c-Si interface. In order for this approach to succeed, these interface problems need to be solved along with improvement of the m-Si layer quality.

37440 **(DOE/JPL/956679—84/2) MOD silver metallization for photovoltaics. Quarterly technical report, March 1, 1984-May 31, 1984.** Vest, G.M.; Vest, R.W. (Purdue Univ., Lafayette, IN (USA). Turner Lab. for Electroceramics). 16 Jul 1984. Contract NAS-7-100-956679. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015509.

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It was demonstrated that the nature of the initial solvent used to extract the silver neodecanoate during synthesis or to render it into solution for ink formulation has a profound influence on fired film properties. The lower the boiling point of the initial solvent, the more of it was removed during rotary vacuum evaporation, and the less effect it had on fired film properties. Benzene and tetrahydrofuran were superior to xylene and toluene, and inks which used them in their preparation produced fired films with excellent appearance and adhesion if the proper firing sequence was used. The best films also had electrical resistivities very close to that of pure silver, which indicates that near theoretical density was achieved. Platinum and palladium metallo-organic compounds were investigated so that fired films with good solder leach resistance could be produced. Six metallo-organic compounds were synthesized, four of them were used to make inks, and the properties of films made from these inks were evaluated. The most promising compound evaluated was Pt 2,4 pentane dionate, but additional studies are required.

37441 **(DOE/JPL/956741—84/01) Comprehensive silicon solar cell computer modeling. Quarterly progress report No. 1, January 5, 1984-April 4, 1984.** Lamorte, M.F. (Research Triangle Inst., Research Triangle Park, NC (USA)). Jun 1984. Contract NAS-7-100-956741. 52p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014762.

The general method to solve the transport equations for a solar cell is discussed. To obtain an accurate representation of a physical system, the system geometry is divided into a number of segments (mesh points). In a one-dimensional geometry, the segments are defined by a series of parallel planes. The separation of the planes defining the segments determines the simulation accuracy. The segments may be taken as thin as required to obtain the accuracy desired. The transport equations, governing the behavior of the physical system, are applied to each segment, and a closed-form solution is obtained in each of the segments. A brief discussion is presented of some of the phenomena submodels in the model and the representations used in the simulation program. The submodels cover such phenomena as mobility, diffusivities, boundary conditions at depletion region edges and those imposed at the mesh points, bandgap narrowing and intrinsic concentration, carrier lifetime, induced surface electric field, and built-in fields. (LEW)

37442 **(DOE/R8/03006—T1) Prospectus for the utilization of leafy spurge (Euphorbia esula L.) as a source of liquid fuel and biomass. Final report.** Wiatr, S.M. (Eastern Montana Coll., Billings (USA). Dept. of Natural Sciences). 1984. Contract FG48-81R803006. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015203.

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This study investigates the biomass potential of leafy spurge (Euphorbia esula). Whole plant biomass yields of 3.6 to 4.9 dry weight tons per acre were obtained from late summer harvests of wild stands in southcentral Montana. Shoot biomass comprised 70% of the harvest with the remainder derived from the basal crowns and first 20 to 30cm of rootstock. Total biomass was comprised of the following components: oils, 3.6%; polyphenols, 6.8%; soluble sugars, 6.1%; starch, 1.1% and protein, 7.1%. Lignin and crude fiber were major biomass components. Shoot biomass contained 44.6% lignin and 40.9% crude fiber while root biomass contained 34.2% lignin and 24.6% crude fiber. Seasonal variation in content was evident for all extractives and classes of biomass. Calorimetric determinations were made for whole plant biomass, extractives and residual biomass. The energy content was as follows: shoot, 4343 cal/g; root, 4214 cal/g and standing dry matter, 4293 cal/g. Whole plant oils had a calorific value of 9513 cal/g with 4976 cal/g for polyphenols and 4228 cal/g in the residue remaining after extraction. Total crop energy yields based on biomass yield and calorific values were 35 to 48 x 10^6 kcal/ha. It is concluded that E. esula does not presently constitute a productive source of whole plant, extractable oils. Alternative uses of E. esula are not dismissed due to the favorable net energy yield calculated for wild stands of this species. Suggested uses include conversion of whole plant biomass to biocrude oil or a multiple use approach to the use of E. esula biomass as a primary source of lignin and crude fiber, and secondary raw materials consisting of extractable oils, polyphenols, protein and fermentable carbohydrates. 57 references, 8 figures, 13 tables.

37443 **(NP—4770430) Experiments on photochemical energy storage with metal-coated zeolites.** Sulzberger, B. (Bern Univ. (Switzerland). Philosophisch-Naturwissenschaftliche Fakultaet). 17 Feb 1983. 154p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770430.

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Photo-oxidation of water to oxygen using silver zeolite catalysts resulted in a pH-dependence and inherent sensitivity of the photo-redox system depending on the type of zeolite used.

37444 **(PNL—5150) Summary of trends in photovoltaic patent activity.** Levine, L.O. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015757.

This report presents information on patent activity for inventions concerning photovoltaic cell technology. Such information can aid in the assessment of the status and direction of technological development. A total of 729 US patents that issued between mid-1962 and the end of 1982, were individually examined and classified into several technical categories for this study. Computerized analysis of trends in patent activity among major technical categories was performed. The level of inventive activity increased dramatically in the mid-1970's. It appears to have peaked in 1978 and remained steady through 1980. The data indicates that, beginning in 1978, an increasing proportion of inventions were among approaches other than the conventional Cz type cells, specifically thin film and concentrator cells. Thin film and Cz type photovoltaic cells represent two-thirds of the patents analyzed. Among thin film patents, silicon and cadmium containing cells represent about two-thirds of the patents analyzed. Further insight into recent trends could be obtained by adding more recently issued patents to the database.

37445 **(SERI/CP—231-2341) Aquatic species program review. Proceedings of the April 1984 principal investigators meeting.** (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 244p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE83012000.

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The purpose of the Aquatic Species program is to improve the productivity, conversion to fuels, and cost efficiency of aquatic plant species for energy. The emphasis of the program is on developing oil-yielding microalgae which will grow in the saline waters of the desert in the American Southwest. To meet this objective, research is carried out under three tasks: biological, engineering, and analysis. The principal objectives of the biological task are (1) to conduct a comprehensive and complete screening activity that will result in the selection of the best microalgae strains for production of fuels; (2) to establish a gene pool so that species can be improved through agronomic means; and (3) to develop techniques that will result in enhancing the yields of the desired fuel product. Engineering research is concerned with integrating biological concepts with engineering principals to develop the most cost-effective microalgal culture technology. Work is concentrated on developing culture management strategies and required subsystems such as harvesting technologies. Analysis supports the technology development through cost goal determination, resource assessment, and technology evaluation. The program also supports the development of macroalgae culture for methane gas or alcohols. This volume contains progress reports presented by the Aquatic Species Program subcontractors and SERI researchers at the SERI Biomass Program Review held in Boulder, Colorado, April 4, 1984. These reports present and discuss research advances achieved by the program participants during the preceding year. Separate abstracts

have been prepared for each report for inclusion in the Energy Data Base.

37446 **(SERI/STR—211-2353) Development of copper sulfide/cadmium sulfide thin-film solar cells. Final report, 13 July 1979-31 May 1983.** Szedon, J.R.; Krishnaswamy, S.V.; McMullin, P.G. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). May 1984. Contract AC02-83CH10093. 205p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84004513.

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Four major issues were addressed and resolved by the work on this program: process transferability, identification and control of key steps for high cell performance, low-cost grid electrodes giving high cell efficiency, and elucidation and suppression of performance-degrading mechanisms. Cell fabrication was shown to be transferable, with adequate attention given to the details of the CdS film deposition. Accurate and reliable monitoring of substrate temperature during CdS deposition can be accomplished by using thermocouples which are welded to molybdenum foil tabs, rather than directly to the copper foil substrate itself. The control of the wet-processing steps for surface texturing and barrier-layer formation can be improved to eliminate subtle operator influences. A special apparatus was designed and tested with a gas knife to dry the cell surface and an enclosure to provide a flowing argon atmosphere for transfers to and from etch, barrier-formation, and rise baths. Provisions of gold grid electrodes by selective electroplating of gold resulted in cell efficiency values up to 30% higher than for a standard processing with thick evaporated gold electrodes. This should be an important avenue for reducing fabrication costs and improving cell performance. Better understanding was gained of factors which affect the degradation of cell performance in atmospheres containing moisture and air. Nonthermal effects of laser treatment were shown to suppress or delay degradation of ceil performance. Such modifications should be important for low-cost encapsulation techniques which allow some influence of air and moisture on the cells.

37447 **(SERI/STR—231-2360) Cultivation and conversion of marine macroalgae.** Ryther, J.H.; DeBusk, T.A.; Blakeslee, M. (Harbor Branch Foundation, Fort Pierce, FL (USA)). May 1984. Contract AC02-83CH10093. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84004522.

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Research was conducted on the development of an alternative ocean energy farm concept that would not be dependent upon deep ocean water or other extraneous sources for its nutrient supply and that could be located in shallow, near shore, and protected coastal ocean areas. There are five tasks reported in this document: determination of the annual yield of Ulva in non-intensive cultures; evaluation of the effect of carbon concentration on Gracilaria and Ulva yields; evaluation of spray/mist culture of Ulva and Gracilaria; species screening for the production of petroleum replacement products; and synthesis analysis, and economic energy evaluation of culture data. An alternative concept to open ocean culture is a land-based energy production system utilizing saline waters from underground aquifers or enclosed coastal areas. Research was performed to evaluate growth and biomass production of all macroscopic algal species that could be obtained in adequate quantity in the central Florida area. A total of 42 species were grown in specially adapted burial vaults. These included 16 green algae (Garcilaria 4 weekshlorophyta), 2 brown algae (Phaeophyta), and 18 red algae (Rhodophyta). Of these, the most successful and suitable species were a strain of Gracilaria (a red seaweed) and Ulva (a green seaweed). These two species have a high carbohydrate content that may be anaerobically digested to methane gas. Well-nourished Gracilaria will double its biomass in 1 to 4 weeks, depending on the season, water flow, and other variables. After its biomass has doubled (i.e., from 2 to 4 kg/m^2) the incremental growth is harvested to return the crop to a starting density. Enrichment of the new starting crop following harvest could conceivably be accomplished onsite at the seaweed farm, but the rapid uptake and storage of nutrients by depleted seaweeds makes possible a simpler process, known as pulse fertilization.

37448 **Factors affecting the efficiency of photochemical water cleavage systems. The reaction between O_2 and the reduced electron acceptor.** Ebbesen, T.W.; Tembe, B.L.; Kozak, J.J. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **88**: No. 4, 683-688(16 Feb 1984).

In an effort to identify and assess the possible experimental problems that arise in effecting a photochemical water cleavage system, the analysis of a prototype water splitting system in the absence and presence of an undesired side reaction was undertaken. The specific experimental system studied is the $Ru(bpy)_3^{2+}$/$Ru(bpy)_3^{3+}$, MV^+/MV^{2+}, system (with dispersed metal/metal oxide catalysts) discovered by Graetzel and co-workers. Their experiment is modeled first as a cyclic system; then, the consequences of considering the side reaction between O_2 and the reduced electron acceptor, MV^+ has been explored. The kinetic analysis draws attention to the means by which the system can be optimized and the back-reactions suppressed, specifically by adjusting concentration levels of the majority species (here, $Ru(bpy)_3^{2+}$, and the catalysts). Further, it clarifies the role of heterogeneous environments in water cleavage systems, emphasizing their importance in influencing cage escape yields. It becomes evident that a major problem here is the presence of undesired side reactions. Accordingly, numerical simulations were performed to study the ideal cyclic system in the presence of the reaction between O_2 and MV^+. The results obtained from a steady-state kinetic analysis and from numerical simulation of the evolution profiles for O_2, H_2 and O_2^- are compared and the extent to which the side reaction involving O_2 compromises the efficiency of H_2 production in the system is quantified.

37449 **Liquid cooled, linear focus solar cell receiver.** Kirpich, A.S. (to Dept. of Energy). US Patent Application 6-559,504. 8 Dec 1983. 29p. Contract AC04-80ET20627.

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Separate structures for electrical insulation and thermal conduction are established within a liquid cooled, linear focus solar cell receiver for use with parabolic or Fresnel optical concentrators. The receiver includes a V-shaped aluminum extrusion having a pair of outer faces each formed with a channel receiving a string of solar cells in thermal contact with the extrusion. Each cell string is attached to a continuous glass cover secured within the channel with spring clips to isolate the string from the external environment. Repair or replacement of solar cells is effected simply by detaching the spring clips to remove the cover/cell assembly without interrupting circulation of coolant fluid through the receiver. The lower surface of the channel in thermal contact with the cells of the string is anodized to establish a suitable standoff voltage capability between the cells and the extrusion. Primary electrical insulation is provided by a dielectric tape disposed between the coolant tube and extrusion. Adjacent solar cells are soldered to interconnect members designed to accommodate thermal expansion and mismatches. The coolant tube is clamped into the extrusion channel with a releasably attachable clamping strip to facilitate easy removal of the receiver from the coolant circuit.

37450 **Cellulose challenge: where do we go from here?.** Lipinsky, E.S. (Battelle's Columbus Lab., OH). *Tappi;* **66**: No. 10, 47-49(Oct 1983).

Because of its relatively low cost and high level of availability, wood has become a popular biomass resource for the manufacture of fuels and chemical products. The producers of high-purity cellulose pulps face problems because the kraft process which is the standard source of dissolving pulp involves huge investments. The article examines the future of this industry and assesses these new technologies: solvent pulping; low lignin biomass and microbial cellulose. 6 references.

37451 **Chemicals from biomass.** Sheppard, W.J.; Lipinsky, E.S. (Battelle Columbus Labs., Columbus). pp 63-71 of Energy from biomass. EC conference, 2. Strub, A.; Chartier, P.; Schleser, G. (eds.). London, England; Applied Science Publishers (1983). (CONF-8209110—).

From 2. conference on energy from biomass; Berlin, F.R. Germany (20 Sep 1982).

Many of the factors that led to the replacement of biomass by petroleum feedstocks for making organic chemicals, such as low

price, stability of price, and geographical diversity of supply no longer apply. Since biomass availability fits the scale of chemical production better than fuel production, biomass opportunitites may exist in chemicals from biomass. A graph of the logarithm of the price of selected chemicals versus the logarithm of the volume of production yields a straight band. The slope of the band has changed as oil prices have risen, with low price-high volume chemicals showing the largest increase. In other words, future price increases for oil will improve the profitability of low-price - high volume chemicals the most. Chemical grade ethanol, lactic acid and acetic acid, all made from biomass by fermentation, appear to offer interesting opportunities.

37452 **Photoinduced electron-transfer reactions of aryl glycosides.** Timpa, J.D.; Legendre, M.G.; Griffin, G.W.; Das, P.K. (Southern Regional Research Center, New Orleans, LA). *Carbohydrate Research;* **117**: 69-80(1983).

The photolytic effects of ultraviolet, as well as other electromagnetic, radiation on carbohydrates are of interest in connection with photodegradation of cellulose and potential application in the photolytic cleavage of lignocellulosic bonds. Aryl glycosides, model compounds for lignocellulosic systems, were irradiated under conditions selected to achieve photoinduced electron-transfer. Various anomeric phenyl D-gluco- and D-galacto-pyranoside solutions in acetonitrile saturated with oxygen, air, or nitrogen and containing 1,4-dicyanonaphthalene (DCN) were irradiated at 350 nm for extended periods, and cleavage of the radical cation formed upon electron transfer to give the simple monosaccharide and phenol was observed. In the presence of methanol, it is possible to intercept the cationic intermediate, with formation of the corresponding methyl glycosides. Control experiments conducted in the presence of oxygen, air, or nitrogen in the absence of DCN showed little or no conversion. Comparison of the modes of fragmentation in solution with those observed in the gas phase upon electron impact in the mass spectrometer was made, and mechanisms for the reactions induced by electron transfer under these conditions are proposed.

1406 Photovoltaic Power Systems

37453 **(AD-A—140146/2) Feasibility of using photovoltaic power systems (PPS) with high pressure sodium (HPS) lamps for magazine entry lighting. Technical note Oct 81-Sep 82.** Watson, G. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Jan 1984. 24p. (NCEL-TN—1685). NTIS, PC A02/MF A01.

New physical security requirements call for nighttime entry lighting to DOD magazines. Many magazine compounds do not have immediate access to electrical powerlines. Photovoltaic power coupled with high efficiency lamps is discussed in this document, and the advantages of this type of system are discussed. Cost comparisons with grid-connected lights are presented.

37454 **(EPRI-AP—3264) Integrated photovoltaic central station conceptual designs. Final report.** Levy, S.L.; Stoddard, L.E. (Black and Veatch, Kansas City, MO (USA)). Jun 1984. 284p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920468.

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Conceptual designs are presented for 100 MW photovoltaic central stations using fixed flat plate, one-axis tracking flat plate, two-axis tracking flat plate, and two-axis tracking high concentration collectors. Designs developed were for specific sites in the southwestern and southeastern United States, and were predicated on mid-1990 plant startup. Estimates of system performance and balance-of-system cost were developed, and cost and efficiency requirements for photovoltaic laminates (unframed modules) and concentrator collectors were derived. Results indicate that all four system types appear potentially viable in the Southwest; fixed and one-axis tracking flat plate concepts appear the best alternatives for the Southeast.

1407 Solar Thermal Power Systems

37455 **(ATR—80(7747)-2) Number of thermal cycles estimated for the 10 MWatt Pilot Plant over its 30 year lifetime.** Randall, C.M. (Aerospace Corp., Los Angeles, CA (USA). Chemistry and Physics Lab.). Jun 1984. Contract AC03-78ET20517. 9p. (STMPO—035). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015320.

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In the 30 year design life of the 10 MW Solar Thermal Pilot Plant nearly 22000 hours of partly cloudy conditions are estimated to occur during daylight plant operating hours. During these partly cloudy hours the plant will experience varying numbers of thermal cycles, depending on the type of clouds. A quantitative extrapolation procedure is provided in this report to convert the number of thermal cycles counted during 8 typical partly cloudy operating scenarios into the number of cycles expected in the design life of the plant.

37456 **(DOE/CS/51101—3) Barstow daily insolation plots, calendar year 1976.** (Aerospace Corp., El Segundo, CA (USA)). 1984. Contract AT03-76CS51101. 367p. (STMPO—027). NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84015319.

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37457 **(DOE/JPL—1060-70) Solar parabolic dish technology annual evaluation report. Fiscal year 1983.** (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Apr 1984. Contract AM04-80AL13137. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014600.

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This report summarizes the activities of the JPL Solar Thermal Power Systems Parabolic Dish Project for FY 1983. Included are discussions on designs of module development including their concentrator, receiver, and power conversion subsystem together with a separate discussion of concentrator development. Analyses and test results, along with progress on field tests, Small Community Experiment system development, and tests at the Parabolic Dish Test Site are also included.

37458 **(DOE/JPL—1060-73) Kinematic Stirling engine as an energy conversion subsystem for paraboloidal dish solar thermal power plants.** Bowyer, J.M. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Apr 1984. Contract AM04-80AL13137. 73p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014616.

The potential of a suitably designed and economically manufactured Stirling engine as the energy conversion subsystem of a paraboloidal dish-Stirling solar thermal power module has been estimated. Results obtained by elementary cycle analyses have been shown to match quite well the performance characteristics of an advanced kinematic Stirling engine, the United Stirling P-40, as established by current prototypes of the engine and by a more sophisticated analytic model of its advanced derivative. In addition to performance, brief consideration has been given to other Stirling engine criteria such as durability, reliability, and serviceability. Production costs have not been considered here.

37459 **(SAND—83-8035) 10 MWe Solar Thermal Central Receiver Pilot Plant: beam safety tests and analyses.** Brumleve, T.D. (Sandia National Labs., Livermore, CA (USA)). Jul 1984. Contract AC04-76DR00789. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015466.

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This report describes analyses and experiments conducted to evaluate potential eye hazards of reflected heliostat beams and to verify the adequacy of the beam safety control strategy at the 10 MWe Solar Thermal Central Receiver Pilot Plant. Special video techniques were used during helicopter flyovers and at ground level to determine retinal irradiance and image size relative to a reference sun. Receiver brightness was also measured. Measured values were consistent with analyses, and safety provisions at the

plant were found to be adequate. Other beam control strategies for heliostats designed to stow face-up in high winds were also studied, and one strategy was checked experimentally during the helicopter flyover tests. Results are presented and recommendations are made for future plants.

37460 **(SAND—84-8228) Assessment of solar thermal concentrator research and development.** Radosevich, L.G.; Caputo, R.S. (Sandia National Labs., Albuquerque, NM (USA); Jet Propulsion Lab., Pasadena, CA (USA)). Jun 1984. Contract AC04-76DR00789. 49p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014461.

Concentrator research and development has been an integral part of the solar thermal technology program since its beginning. Within the central and distributed receiver programs, a considerable amount of research and development has been successfully concluded: over twenty-five line focus (mostly parabolic trough) designs, thirteen heliostat designs, and eight parabolic dish designs have been fabricated and tested under Department of Energy sponsorship; mass-production costs have been estimated for several of these designs; and materials and components research is under way to identify areas for both cost and performance improvements. An overall assessment of this work has recently been performed to determine future research and development needs. This report describes the results of this assessment and presents recommendations for future concentrator research and development.

37461 **(SAND—84-8229) Technical review of the solid particle receiver program, January 25-26, 1984.** Falcone, P.K. (comp.). (Sandia National Labs., Livermore, CA (USA)). Jul 1984. Contract AC04-76DR00789. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015181.

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The use of solid particles as the working fluid and storage medium in solar central receivers is one approach to delivering solar energy at temperatures above the nominal 550°C (1100°F) peak of current water-steam and molten salt central receiver technologies. The technical feasibility of the solid particle concept is the subject of an ongoing examination at Sandia National Laboratories Livermore (SNLL). A review of the individual investigations in this program was conducted in Livermore on January 25-26, 1984. The meeting was held to discuss the status of the technical feasibility investigations one year into this phase of study and to set direction for the future. The technical review meeting served three purposes. It provided a follow-up to the reviews held in January and July 1983. It afforded a means of reviewing what had been accomplished over the last year, and it presented an opportunity for adding to and revising planned work. Summaries of each of the individual presentations at the review meeting, as well as an overview of the program are presented.

1408 Ocean Energy Systems

37462 **(CONF-840930—1) Biofouling and corrosion studies at the Seacoast Test Facility in Hawaii.** Panchal, C.B.; Stevens, H.S.; Genens, L.E.; Hillis, D.L.; Larsen-Basse, J.; Zaidi, S.; Daniel, T. (Argonne National Lab., IL (USA); Hawaii Univ., Honolulu (USA). Hawaii Natural Energy Inst.). 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014643.

From OCEANS '84 conference and exposition; Washington, DC, USA (10 Sep 1984).

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Results from the first three years of operation are presented. No detectable biofouling from cold water in smooth tubes has been observed. Intermittent, low-level chlorination appears to control biofouling from warm water in smooth tubes. Uniform corrosion of 5052 aluminum alloy is low, with less pitting found with warm water than with cold water over the same period. Although the testing of waterside enhancements has just begun, results to date indicate that low-level chlorination may be effective in preventing biofouling buildup on such enhancements. Corrosion data indicate that aluminum-based materials may achieve long service lives in marine environments.

37463 **The exergy of the ocean thermal resource and analysis of second-law efficiencies of idealized ocean thermal energy conversion power cycles.** Johnson, D.H. (Solar Energy Research Inst., Golden, CO). *Energy (Oxford);* 8: No. 12, 927-946(Dec 1983).

The authors develop a formula here to compute the maximum amount of work which can be extracted from a given combined mass of warm and cold ocean water (a quantity called the exergy of the ocean thermal resource). He then compares the second-law efficiencies of various proposed ocean thermal energy conversion power cycles to determine which best utilizes the exergy of the ocean thermal resource. The second-law efficiencies of the multicomponent working fluid cycle, the Beck cycle, and the open and closed single- and multiple-stage Rankine cycles are compared. These types of OTEC power plants are analyzed in a consistent manner, which assumes that all deviations from a plant making use of all the exergy (one with a second-law efficiency of 100%) occur because of irreversible transfer of heat across a finite temperature difference. Conversion of thermal energy to other forms is assumed to occur reversibly. The comparison of second-law efficiencies of various OTEC power cycles shows that the multistage Rankine open cycle with just three stages has the potential of best using the exergy of the ocean thermal resource.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 14090037399

37464 **(DOE/CS/30512—T1) Solar heating and cooling R and D program coordination support. Final report, October 1, 1980-September 30, 1983.** (TPI, Inc., Bethesda, MD (USA)). Jan 1984. Contract AC03-80CS30512. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013479.

The objective of the project was to support the US Department of Energy's international R and D activities in the solar heating and cooling area. The cooperative programs were of two types: bilateral (involving the US and one other country) and multilateral (involving the US and several other countries). The multilateral programs supported under this contract were: International Energy Agency Solar Heating and Cooling Program; and NATO/CCMS Solar Energy Pilot Study. Solar heating and cooling projects under the following bilateral programs were supported: US/Mexico; US/Israel; and US/Spain. The assistance to DOE's Office of Solar Heat Technologies, consisted primarily of program management and coordination support, plus a smaller amount of technical support. This final report summarizes the work performed during the three years of this contract and the accomplishments.

37465 **(DOE/CS/30576—T1) Modeling of a second-generation solar-driven Rankine air conditioner. Final report.** Denius, M.W.; Batton, W.D. (Barber-Nichols Engineering Co., Arvada, CO (USA)). Jul 1984. Contract AC03-81CS30576. 158p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015132.

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Ten configurations of a second-generation (2G), solar-powered, Rankine-driven air conditioner were simulated and the data presented for use in companion studies. The results of the analysis show that the boiling-in-collector (BIC) configuration generates more power per collector area than the other configurations. The models used to simulate the configuration are presented in this report. The generated data are also presented. Experimental work was done under this study to both improve a novel refrigerant and oil lubrication system for the centrifugal compressor and investigate the aerodynamic unloading characteristics of the centrifugal compressor. The information generated was used to define possible turbo-gearbox configurations for use in the second generation computer simulation.

37466 **(DOE/CS/30576—T2) Turbine test report. Addendum to final report.** Elliott, T.J.; Batton, W.D. (Barber-Nichols Engineering Co., Arvada, CO (USA)). Jul 1984. Contract AC03-81CS30576. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015130.

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The radial inflow turbine developed for the NASA 404 program 25-ton solar air conditioner (RCWS-2-2753-GO) was tested for performance. Using the converging-only nozzles designed for this system, a peak efficiency of 86% was measured at a pressure ratio of 2.7 and a velocity ratio of 0.66. Near the design pressure ratio of 3.5 and velocity ratio of 0.645, the measured pressure ratio of 3.5 and velocity of 0.645, the measured efficiency was 84% instead of the predicted 82%. Data are presented for pressure ratios of 2.7, 3.6, and velocity ratio ranges of 0.20 to 0.85. This covers the normal operating range of interest in this machine. The performance is better than predicted. This indicates that some of the loss coefficient values assumed during the original analysis were conservative.

37467 **(DOE/CS/30582—T1) Heat Mirror II: an advanced transparent insulation. Phase II. Final report.** Cormia, R.L. (Southwall Corp., Palo Alto, CA (USA)). Jun 1982. Contract FC02-80CS30582. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014158.

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The purpose of this project was to take five separate approaches to achieve an environmentally stable Heat Mirror II. Heat Mirror I is limited to use in hermetically sealed, dessicated environments to avoid risks to its integrity from physical abuse and atmospheric chemical attack. In this report, the following five tasks were addressed, each designed to give Heat Mirror I greater durability: surface preparation of the substrate; alternative thin film stack design; passivation of the thin film stack; overcoating; and laminating. It is concluded that the laminate is very promising and should be further tested.

37468 **(DOE/CS/31457—T1) Solar production of industrial process steam at the Home Cleaning and Laundry Co. Final technical report.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). Jun 1984. Contract AC03-77CS31457. 151p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84013385.

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This report presents the results of the operation and performance evaluation period at the Home Laundry Solar Industrial Process Heat Project at Pasadena, California. The installation comprises 6496 ft^2 (603.5 m^2) of linear parabolic trough concentrating collectors supplying solar thermal energy for use in laundry and dry cleaning processes. The design phase began in September 1977, and an acceptance test was conducted during the week of April 12, 1982. The plant has been in operation since May 1982, with the 12-month Phase III (operational) period starting in October 1982. The objective of the operational evaluation experiment was to maximize energy delivery to the industrial participant while characterizing system performance. Data were acquired for monthly documentation of system performance, maintenance requirements, and operating costs.

37469 **(DOE/R7/01036—T1) Enterprise solar air to rock/wood assisted heating system.** Atherton, M. (East Wind Community, Tecumseh, MO (USA)). 1984. Contract FG47-79R701036. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007741.

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This report ontains the final project plans for the construction of an active solar air-to-rock forced air heating system which is assisted by an 80% efficient wood furnace. The system uses 800 square feet of flat plate collectors. The furnace system will burn wood at approximately 1500°F, and store heat in a second rock bin. The following are presented and discussed: overview of system; air duct design and specifications; collector design and specifications; heat storage design and specifications; wood furnace design and specifications; electronic controls; fan sizing; control room specifications; heat load calculations and economic analysis.

37470 **(DOE/R7/01103—T1) Development of common stud wall for passive solar collector and storage device. Final progress report.** Christensen, R. (Christensen (Rhys), Ames, IA (USA)). 13 Jul 1982. Contract FG47-80R701103. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015240.

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This report describes the design and construction of a shop built vertical wall collector and the integration of the collector with site built techniques to make a complete solar system installation.

37471 **(DOE/R7/01230—T1) Passive solar hot water heater. Final report.** (Solar Energy Associates Ltd., Omaha, NE (USA)). 25 Jun 1984. Contract FG47-81R701230. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015239.

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This study involves the design and testing of a passive solar hot water heater. The primary goals are to achieve freeze protection without having to resort to antifreeze, manually operated shutters, or the use of mechanical aids. The objective was to test the heater under severe winter climate conditions. Data is presented to demonstrate that such a hot water heater can operate effectively in freezing climates. The hot water heater developed and tested in this study utilized Teflon as a multiple glazing in a unique upside down collection system. Heat loss is minimized in such a design, and manual operation is avoided. Performance results indicate that such a system also obviates the need for freeze protection.

37472 **(IS—4855) Comparison of standard and low iron glazing in Trombe wall applications. Final report.** Szydlowski, R.F.; McClelland, J.F. (Iowa State Univ. of Science and Technology, Ames (USA). Energy and Mineral Resources Research Inst.). 1984. Contract W-7405-ENG-82. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014870.

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Passive solar heating performance of standard and low iron glazing was measured in side-by-side Trombe wall tests during the winter of 1982-83 in Ames, Iowa. Performance differences for the two glazing materials were minimal under the climate conditions of the test. Higher thermal losses from the low iron glazed Trombe wall appear to have reduced the benefit of higher solar transmission characteristic of low iron glass. Movable insulation or heat mirror surfaces, combined with low iron glass, could increase the enhancement value of this glazing material.

37473 **(Juel—1882) Performance and cost analysis of pressurized and non-pressurized domestic solar water heating systems with thermosyphonic flow.** Uhlemann, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung). Dec 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751909.

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Two commercially available domestic hot water heating systems were studied experimentally under identical meteorological conditions. One of the systems consisted of a meander type of flat plate collector connected to a 110 l storage tank, which was maintained under the pressure of city water supply. The other system consisted of two flat plate collectors connected in parallel to each other with a 200 l pressure-free water storage tank. For an incident solar energy of 6.75 kWh per m^2 of collector area, the useful energy available from the pressurized and the non-pressurized system is 3.0 kWh and 3.8 kWh per unit collector area respectively, yielding over the decay an average efficiency of 45 and 57%. A cost analysis helps to calculate the cost of energy supplied by the water heating systems. Numerical calculations are performed for typical market conditions of two developing countries, namely Egypt and India. These show that such domestic solar water heating systems have considerable market potential in comparison to conventional hot water systems such as gas boilers and electrical boilers.

37474 **(PB—84-188515) Residential Solar Heating Demonstration: final report of the management contractor, volume 2: solar repair program. Final report.** (BE and C Engineers, Inc., Tukwila, WA (USA)). Jun 1983. 0100p. NTIS, PC A05/MF A01.

One of the most significant tasks accomplished during the Residential Solar Heating Demonstration was the effort expended in making solar-system repairs. The report discusses the types of solar repairs required and illustrates the problems involved in these repairs by highlighting eight case studies. The problems included control system failures, serious collector glazing breakage, leakage and outgassing, excessive net losses from storage, leaking collector connections, poor recirculation within systems, and poor to negative solar contribution. There were a total of 229 System Operating Problem Reports in the repair program, involving 229 grants and 599 systems. The eight case studies include four cases of active liquid systems and active air systems for single-family heating and domestic hot water; one case of a passive design; two cass covering large-scale, multifamily domestic hot water systems; and one multifamily heating and domestic hot water system. The report notes how the problems encountered could have been avoided, focusing on design, manufacturing, installation, and maintenance and operating deficiencies. Figures and tables are supplied.

37475 **(PB—84-188523) Residential Solar Heating Demonstration: final report of the management support contractor, volume 3: high temperature exposure of wood structures in solar systems. Final report.** (BE and C Engineers, Inc., Tukwila, WA (USA)). Jun 1983. 0075p. NTIS, PC A04/MF A01.

This document provides solar energy system engineers, designers, and manufacturers with actual experience-type data related to high temperature exposure of wood structures in solar systems and with design recommendations oriented to reducing these temperatures during use. A collector conditions survey was conducted to identify collector systems that were susceptible to fire hazards. A total of 36 systems, including solar attics, site-built air and liquid collectors, and manufactured collectors were identified as potentially hazardous and investigated. Results showed that no apparent fire-related life-safety hazards were present in the 36 systems; however, significant degradation of thermal insulation and adjacent wood structure was observed. The most severe degradation was found in solar attics and site-built collectors. Three projects, two with solar attics and one with a site-built air system, were selected for further investigation. These projects were instrumented to determine maximum wood temperatures during priods of high solar insolation. Measurements were taken under various conditions. This document contains the analyses of these data and recommendations for reducing temperatures of wood structures in solar systems. In each case, the intent is to lower air temperatures, reduce the thermal absorptance of structural wood surfaces, and provide thermal insulation between wood and gypsum board surfaces and the collector absorber materials. Data tables, figures, and four references are supplied. Technical specifications are appended.

37476 **(SERI/TR—253-2120) Summary and assessment of historical reliability and maintainability data for active solar hot water and space conditioning systems.** Jorgensen, G.J. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84004521.

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This report identifies and summarizes 20 reliability and maintainability (R and M) studies on active solar energy systems. Most of the data deals with liquid systems for solar domestic hot water applications. The studies showed drainback and recirculation systems to be the most reliable of the liquid systems and antifreeze and oil systems to be moderately reliable. The studies identified storage to be the most reliable subsystem. The problems generally were caused by improper installation or maintenance. Although transport subsystems had many problems, they were not severe. Collector subsystems had a 30 to 50% failure rate caused mostly by leaks, damaged glazing seals and gaskets, and freezing. Piping/ducts and controls also have poor reliability and, along with collectors, require further research. Pumps, fans, valves, and dampers are intermediately reliable.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 14100037457

37477 **Black chrome solar selective coatings optimized for high temperature applications.** Pettit, R.B.; Sowell, R.R.; Hall, I.J. (Sandia National Lab., Albuquerque, NM). *Solar Energy Materials;* 7: 153-170(1982). Contract AC04-76DP00789.

A statistical design approach has been used on a specified set of plating parameters to optimize the thermal stability of electrodeposited black chrome solar coatings. Plating parameters studied included the bath composition (chromic acid, acetic acid, trivalent chromium and iron), current density, plating time, substrate and bath temperature. The optimization procedure consisted of maximizing the solar absorptance values after thermal aging at high temperatures (up to 450°C in air. The estimated functional dependence of the thermally aged solar absorptance values on the four bath constituents was determined in the region of most stable coatings. This relationship was used to specify a range of bath compositions that provide coatings with optimum thermal stability. It was also found that chloride ion contamination of the black chrome plating solution significantly degraded the thermal stability of plated coatings. Fortunately, the chloride ions could be effectively removed through the addition of silver oxide, which precipitates silver chloride. When the plating variables were properly controlled, electrodeposited black chrome coatings were obtained which should maintain solar absorptance values of 0.96 or higher during years of operation at 300°C in air.

1420 Heat Storage

REFER ALSO TO CITATION(S) 14200037731

37478 **(SERI/TR—231-2131) SERI solar energy storage program: FY 1983 annual report.** Luft, W.; Bohn, M.S.; Copeland, R.J.; Nix, R.G. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84004525.

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This report summarizes the activities of the Solar Energy Research Institute (SERI) Solar Energy Storage Program during its fifth year, FY 1985. This program provides supporting research and technology and systems analyses and assessments to the US Department of Energy (DOE) Thermal Energy Storage Program. In FY 1983, SERI researched direct-contact heat exchange, latent- and sensible-heat storage, and thermochemical energy storage and transport to reduce cost. Further analysis of thermal energy storage identified storage technologies worth developing.

15 GEOTHERMAL ENERGY

37479 **(DOE/ET/28466—T1) United States Gulf Coast geopressured geothermal program. Special projects research and coordination assistance. Final report, 1 December 1978-30 October 1980.** Dorfman, M.H.; Morton, R.A. (Texas Univ., Austin (USA)). Jun 1981. Contract AS05-76ET28466. 189p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013687.

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Work for the period, December 1, 1978 through October 31, 1980, is documented. The following activities are covered: project technical coordination assistance and liaison; technical assistance for review and evaluation of proposals and contract results; technical assistance for geopressured-geothermal test wells; technical assistance, coordination, and planning of surface utilization program; legal research; and special projects. (MHR)

1502 Geology And Hydrology Of Geothermal Systems

37480 **(DOE/ID/12033—T4) Summary of geothermal studies in Montana, 1980 through 1983. DOE final report.** Sonderegger, J.L. (Montana Bureau of Mines and Geology, Butte (USA)). 1984. Contract FC07-79ID12033. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014325.

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The geology, hydrology, and surface manifestations of geothermal systems in Montana are described by area. Water-quality information, tables of inventory and water analysis data for springs and wells, and a geothermal resource map are included. (MHR)

37481 **Acoustic emissions during hydraulic fracturing in granite.** Pearson, C.; Albright, J.N. (Los Alamos National Lab., NM). *Series on Rock and Soil Mechanics;* 559-575(1984). (CONF-811036—).

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

Hydraulic stimulation experiments being conducted in low-permeability crystalline rocks, at the Department of Energy's Hot Dry Rock Geothermal Site, Fenton Hill, New Mexico, often produce large numbers of microearthquakes. Typically, the early stages of these experiments are aseismic. The rate of acoustic emissions increases rapidly after a critical volume of water, equal to roughly two-thirds of the total amount previously injected, is exceeded, possibly indicating the onset of fracture extension. With local magnitudes ranging between -1 and -6, these events occurring at 3-km depth are too small to detect using surface seismometers, so we monitor the activity using a downhole triaxial geophone system(s) positioned in well(s) close to the reservoir volume. The system provided enough data in early experiments to locate the events using single station seismometry. Recently it became possible to station a second geophone system in a nearby well, that provides valuable additional constraints on event locations. The second tool was also used to measure relative changes in attenuation by comparing signal frequencies for the same event recorded on the two tools. P-wave attenuation does not vary significantly with the source region of the event, however, S-wave attenuation is quite variable, with Q ranging from 170 to 40. This suggests that the attenuation may be due to open water-filled fractures. We located large numbers of acoustic events during three hydraulic stimulation experiments, two of which occurred in March 1979 and one in December 1980. During the first two, event locations clustered near a single north-by-northwest trending vertical plane. During the third experiment (after an extended period of heat extraction) the same general trend was evident, but the zone was much wider and events seemed to occur on a series of parallel planes indicating a more complex structure within the reservoir.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 15030037480

37482 **(DOE/ID/12026—T6) Chemical analyses of selected thermal springs and wells in Wyoming.** Heasler, H.P. (Wyoming Univ., Laramie (USA). Dept. of Geology and Geophysics). Jun 1984. Contract FC07-79ID12026. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015189.

Basic chemical data for 27 selected thermal well and springs in Wyoming are presented. The samples were gathered from 1979 through 1982 in an effort to define geothermal resources in Wyoming. The basic data for the 27 analyzed samples generally include location, temperature, flow, date analyzed, and a description of what the sample is from. The chemical analyses for the sample are listed.

37483 **(LA—10128-MS) Correlation of wireline log characteristics with hydrothermal alteration and other reservoir properties of the Salton Sea and Westmorland geothermal fields, Imperial Valley, California, USA.** Muramoto, F.S.; Elders, W.A. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015088.

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A detailed study of wireline logs from 11 wells in the Salton Sea and Westmorland geothermal systems was undertaken in order to determine the effects of hydrothermal alteration on the response of electrical and gamma-gamma density well logs. For the Salton Sea geothermal field, definite correspondence between log responses and hydrothermal mineralogy is evident, which in turn is related to the physical properties of the rocks. Three hydrothermal and one unaltered zone can be identified from log data on shales. These are: (1) the unaltered montmorillonite zone ($<100^{\circ}$ to 190°C); (2) the illite zone (100° to 190°C to 230° to 250°C); (3) the chlorite zone (230° to 250°C to 290° to 300°C); and (4) the feldspar zone ($>290^{\circ}$ to 300°C). The characteristic responses on well logs by which these zones are identified result primarily from changes in clay mineralogy of the shales and increases in density with progressive hydrothermal metamorphism. In the Westmorland geothermal field, differentiating mineral zones from log responses was only partially successful. However, analyses of both well log and petrologic data for wells Landers 1 and Kalin Farms 1 suggest that the former is heating up and the latter is cooling.

37484 **(LBL—17859) Seismic discrimination of a geothermal field: Cerro Prieto.** Blakeslee, S. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 9p. (CONF-840809—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014581.

From Geothermal Resources Council annual meeting; Reno, NV, USA (27 Aug 1984).

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Extensive reprocessing of a subset of the seismic reflection data from Cerro Prieto has been performed. The formations and faults identified in the resulting seismic profile were correlated to cross-sections constructed from well log data. The production region coincides with a zone of reflection attenuation. A detailed velocity analysis reveals a lid of high velocity events rimming the reflection attenuation zone. This may prove to be a valuable discriminant for locating a geothermal resource using seismic reflection data.

37485 **Geologic interpretation of geothermal fluid movement in Cerro Prieto Field, Baja California, Mexico.** Halfman, S.E.; Lippmann, M.J.; Zelwer, R.; Howard, J.H. (Univ. of California, Berkeley). *American Association of Petroleum Geologists, Bulletin;* **68**: No. 1, 18-30(Jan 1984). Contract AC03-76SF00098.

From American Association of Petroleum Geologists Southwest Section Meeting; Midland, TX (5 Feb 1984).

A geologic model of the liquid-dominated Cerro Prieto geothermal field was developed on the basis of geophysical and lithologic well logs. The direction of subsurface geothermal fluid flow before exploitation, and the geologic features controlling this movement were determined by integrating well completion and downhole temperature data with the geologic model. The data show that fluid (possibly heated by intrusive dikes found in wells drilled in the eastern area of the field) enters the system from the east depths $>$ 10,000 ft ($>$3,050 m). The fluid moves westward through sandstone beds and rises to shallow depths through fault zones and permeable sandy gaps in the overlying shale layers. The shale layers provide local cap rocks. Some of the hot fluid reaches the surface west of the field, in an area characterized by numerous geothermal manifestations. The rest of the fluid mixes with colder ground waters west of the geothermal resource. 15 figures, 1 table.

1504 Legal And Institutional Aspects

37486 **Geothermal Steam Act amendments of 1983.** Washington, DC; Government Printing Office (1983). 150p.

A hearing on two bills (S. 558 and S. 883) amending the Geothermal Steam Act of 1970 addressed the need to facilitate commercial development without jeopardizing the thermal features of national parks and monuments. A report from the Department of Agriculture (USDA) notes that many of the most promising geothermal resources are in protected areas, and that the amendments remove USDA protection. The 10 witnesses included representatives of states, national parks and conservation interests, energy companies, and government agencies. The hearing record includes the texts of both bills, the USDA report, testimony, and an appendix with additional material submitted for the record.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 15050037492

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 15060037486

37487 **(DOE/ID/12167—T1) Evaluation of irrigation management procedures for geothermal effluent.** Brockway, C.E.; Robbins, C.W.; Robison, C.W.; Johnson, G.S. (Idaho Univ., Moscow (USA). Idaho Water and Energy Resources Research Inst.). Jun 1984. Contract AS07-80ID12167. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015188.

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An investigation was conducted to determine the feasibility of geothermal power plant effluent disposal by surface irrigation and the resulting impact on the shallow aquifer. The study was conducted at the Raft River Experimental Geothermal Power Plant site near Malta, Idaho and at the Snake River Conservation Research Center with soils and effluent obtained from the geothermal power plant site.

37488 **(DOE/ID/12210—T1) Near-surface groundwater responses to injection of geothermal wastes.** Arnold, S.C. (Idaho Univ., Moscow (USA). Idaho Water and Energy Resources Research Inst.). Jun 1984. Contract AM07-81ID12210. 148p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015139.

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Experiences with injecting geothermal fluids have identified technical problems associated with geothermal waste disposal. This report assesses the feasibility of injection as an alternative for geothermal wastewater disposal and analyzes hydrologic controls governing the upward migration of injected fluids. Injection experiences at several geothermal developments are presented, including: Raft River, Salton Sea, East Mesa, Otake and Hatchobaru in Japan, and Ahuachapan in El Salvador. Hydrogeologic and design/operational factors affecting the success of an injection program are identified. Hydrogeologic factors include subsidence, near-surface effects of injected fluids, and seismicity. Design/operational factors include hydrodynamic breakthrough, condition of the injection system and reservoir maintenance. Existing and potential effects of production/injection on these factors are assessed.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 15080038055

37489 **Velocity pump reaction turbine.** House, P.A. (to Dept. of Energy). US Patent 4,430,042. 7 Feb 1984. Filed date 11 Feb 1982. vp.

PAT-APPL-347821.

An expanding hydraulic/two-phase velocity pump reaction turbine including a dual concentric rotor configuration with an inter-rotor annular flow channel in which the inner rotor is mechanically driven oy the outer rotor. In another embodiment, the inner rotor is immobilized and provided with gas recovery ports on its outer surface by means of which gas in solution may be recovered. This velocity pump reaction turbine configuration is capable of potential energy conversion efficiencies of up to 70%, and is particularly suited for geothermal applications.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 15090038658

37490 **(EPRI-AP—3572) Geothermal downwell pump reliability: state-of-the-art assessment. Final report.** Ellis, P.F. II; Green, T.F.; Williamson, H.J. (Radian Corp., Austin, TX (USA)). Jun 1984. 104p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920433.

The current and near-term state of the art of high-temperature (250-365°F, 121-185°C) geothermal downwell pumps was assessed by investigating the causes of failure of more than 70 lineshaft and electric submersible pumps. Recent developments in novel downwell pumping technology were also reviewed. These data were used to estimate the likely near-term availability factor of high-temperature downwell pump systems. In an industry survey completed in April 1983, it was found that both lineshaft and electric submersible pumps have encountered repeated and severe difficulties when pumping fluids above 250°F (120°C) in geothermal wells. Sixty-three percent of the lineshaft and 83% of the electric submersible pumps failed. The average run life was less than two months. However, both lineshaft and electric submersible pumps have undergone recent developments that strongly suggest that a significant improvement has occurred. Near-term lives were estimated based on engineering judgment in light of recent developments. It was concluded that near-term and electric submersible pumps will have a probable average run life of 6-12 months in resources up to 365°F (185°C). Statistical modeling showed that if average run lives reach 6-12 months as expected, then the near-term pumping technology is capable of providing reliable brine supply to a large geothermal binary plant.

37491 **(SGP-TR—76) Geothermal reservoir engineering research at Stanford University. Third annual report for the period October 1, 1982-September 30, 1983.** Ramey, H.J. Jr.; Kruger, P.; Horne, R.N.; Brigham, W.E.; Miller, F.G. (Stanford Univ., CA (USA). Stanford Geothermal Program). Sep 1983. Contract AT03-80SF11459. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84011853.

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Progress is reported in the following areas: heat extraction from hydrothermal reservoirs; radon reservoir engineering; well test analysis and bench scale experiments; field applications; workshop, seminars, and technical information; reinjection technology; and seismic monitoring of vapor/liquid interfaces. (MHR)

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 15100037416, 37417

37492 **Investment in geothermal direct-heat applications.** Hederman, W.F. Jr.; Gordon, L.C. (Interstate Natural Gas Association of America, Washington, DC). *Energy Journal;* 5: No. 1, 85-97(Jan 1984). Contract AC07-80ID12099.

An assessment of eight geothermal direct-heat projects for which confident cost and production data exists indicates that low-temperature geothermal resource can, in certain instances, provide an inexpensive, reliable source of direct-heat energy. The analysis examines the retrofit investment decision separately for private firm and local government investors. It compares the economics of geothermal and conventional energy supplies, and explores the sensitivity of these comparative results to changes in the underlying assumptions. Investors are warned that geothermal direct-heat applications projects have not been uniformly successful. Three of the eight projects do not appear to be economical when compared to conventional alternatives even though all eight are the most advanced of 22 demonstration projects originallly funded by DOE. 6 references, 1 figure, 6 tables.

17 WIND ENERGY

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 17010037430

37493 **(PB—84-184613) Wind energy assessment for western Maryland. Final report.** Garstang, M. (Simpson Weather Associates, Charlottesville, VA (USA)). Jan 1984. 115p. NTIS, PC A06/MF A01.

A substantial and systematic body of wind velocity measurements near the surface has been assembled for three test sites in western Maryland. These data have been subjected to careful quality control and have been compiled in well documented computer compatible format suitable for general use by other scientists, engineers and technical planners.

37494 **(PB—84-184951) High yield wind energy resources in the mid-Hudson River Basin. Final report.** Sforza, P.M.; Bailey, B.H. (Flowpower, Inc., Huntington Station, NY (USA)). Dec 1983. 114p. NTIS, PC A06/MF A01.

Sponsored in part by Central Hudson Gas and Electric Corp., Poughkeepsie, NY; Prepared in cooperation with State Univ. of New York at Albany, Atmospheric Sciences Research Center.

The report describes the results of a wind resource assessment program in the mid-Hudson River Basin area that resulted in a year-long hourly record of wind speed and direction data at two tower levels and four sites. Three of these sites are typical of the exposed hilly terrain characteristic of the Catskill Region. The average annual wind speed for the period of this study was 12.6 to 15.4 miles per hour at the 100-foot tower level. The performance of wind systems ranging in capacity from 55 to 7200 kW was evaluated using the hourly wind data and manufacturer-supplied power curves. Total energy production and cost estimates for these wind systems were then used to calculate levelized cost of energy and internal rate of return calculations for the wind systems evaluated. The internal rate of return with and without the 15 percent Federal energy investment tax credit and five-year accelerated depreciation was calculated using a discounted cash-flow method. In the best wind resource case available, the average internal rates of return on investment with and without the energy investment tax credit and depreciation schedule were 21 percent and 12 percent, respectively.

1706 Wind Energy Engineering

37495 **(BMFT-FB-T—84-063) Wind energy converter GROWIAN II.** Braun, D.; Kloeppel, V.; Marsch, G.; Meggle, R.; Mehlhose, R.; Schoebe, B.; Wennekers, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 148p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751901.

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The objective of the program was to investigate advanced concepts for multi-MW-wind energy conversion systems in the rotor class of 135 m diam. A concept selection was performed amongst two-bladed and one-bladed candidate systems. The preferred solution was a variable-speed horizontal-axis downwind machine with a one-bladed teetering rotor and a guyed soft steel tower. A 1 : 3 scaled demonstrator with a rotor diameter of 48 m was built and erected at a site close to Bremerhaven. The demonstrator will undergo a 2-years verification test program under a follow-on contract.

37496 **(BMFT-FB-T—84-080) German-Argentinian R and D-project for the utilization of wind energy.** Axenath, K.H.; Fritzsche, A.; Rogalla, K.; Schmelzle, J.; Welte, D.; Wirths, G.; Tetzlaff, G.; Vollan, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)). May 1984. 90p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751934.

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In December 1978 Dornier System and its Argentinian partner CNIE startet the development of a 20 kW windenergy converter. After comprehensive preparatory meteorological work of the "Institut fuer Klimatologie und Meteorologie der Universitaet Hannover", the airport of Comodoro Rivadavia, 1600 km south of Buenos Aires, was finally selected as the test site in autumn 1979. Argentinian engineers worked together with German engineers on the Dornier premises during the development, preintegration and components test phases, which were completed at the end of 1980. In cooperation with the Argentinian engineers the wind energy converter was installed in Comodoro Rivadavia within several days only and put into operation in April 1981. The functional tests of all components up to wind speeds over the operational range were very successful.

37497 **(DOE/NASA/20320—59) Effect of vortex generators on the power conversion performance and structural dynamic loads of the Mod-2 wind turbine.** Sullivan, T.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1984. Contract AI01-76ET20320. 27p. (NASA-TM—83680). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015014.

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Applying vortex generators from 20 to 100 percent span of the Mod-2 rotor resulted in a projected increase in annual energy capture of 20 percent and reduced the wind speed at which rated power is reached by nearly 3 m/sec. Application of vortex generators from 20 to 70 percent span, the fixed portion of the Mod-2 rotor, resulted in a projected increase in annual energy capture of about half this. This improved performance came at the cost of a small increase in cyclic blade loads in below rated power conditions. Cyclic blade loads were found to correlate well with the change in wind speed during one rotor revolution.

37498 **(DOE/R7/01020—T1) Aeration/Drying of stored grain using Andreau-type windmill. Final technical report.** Ward, W.H. (Department of Energy, Kansas City, MO (USA). Region VII). 1984. Contract FG47-79R701020. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015238.

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The ability to aerate grain with an Andreau-type wind machine was demonstrated. Design modifications are discussed. (LEW)

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 20000039072

37499 **(EPRI-EL—3591-Vol.1) Effects of reduced voltage on the operation and efficiency of electric systems. Final report. Volume 1: field tests and computer code development.** Chen, M.S.; Shoults, R.R. (Texas Univ., Arlington (USA). Energy Systems Research Center). Jun 1984. 286p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920452.

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This volume descibes the tests on selected residential, commercial, and small industrial areas of the Texas Electric Service Co. system and the statistical analysis performed on the test data gathered. The purpose of field testing was to provide data to analyze changes in energy consumption due to changes in feeder voltage levels. These results were also used for the purpose of validating the simulation capability of the distribution system analysis and simulation (DSAS) program, developed in conjunction with the field test activity. The primary function of the DSAS program is to provide detailed simulation of a distribution feeder utilizing load energy models and three-phase circuit modeling. The DSAS program is capable of predicting energy changes as a function of voltage at the circuit level. The data preparation and input requirements are very detailed and somewhat tedious, but computer simulation is considerably less involved than planning and conducting field tests over some extended period of time.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 20010037037, 37056, 37058, 37059, 37060, 37149, 37154, 37158, 37164, 37533, 37771

37500 **(CONF-840576—2) Control of power systems to ϵ-optimize the probability distribution of the time to insecurity.** Liu, C.C.; Wu, F.F. (Washington Univ., Seattle (USA). Dept. of Electrical Engineering; California Univ., Berkeley (USA)). 1984. Contract AC01-82CE76221. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013873.

From International symposium on circuits and systems - ISCAS'84; Montreal, Canada (7 May 1984).

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Security of a power system is considered to be an instantaneous measure of a system's robustness with respect to imminent disturbances such as load fluctuations, equipment failures and short circuits. The security control deals with the operation of generation rescheduling, transmission line switching, or load management to raise the security level of a power system. To maintain system security is crucial in the on-line operation of power systems. In this paper, the security control via generation rescheduling is investigated. A continuous time Markov chain (CTMC) model is proposed for the power system. The framework for probabilistic dynamic security assessment is modified for the proposed CTMC model. In power system operation, it is more desirable to maintain a uniformly high security level. Therefore, the proposed objective for optimal security control is to maximize the probability that the system remains secure at time t for all t in a finite horizon [0,T]. An iterative procedure similar to the policy iteration of dynamic programming is developed to generate an ϵ-optimal generation schedule.

37501 **(DOE/ET/10393—1589) Design and installation of a condensate recovery system.** (NCB (IEA Grimethorpe) Ltd., Grimethorpe, Barnsley, South Yorkshire (UK)). Dec 1980. Contract AI01-76ET10393. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009276.

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The Grimethorpe Experimental Facility was designed to use steam from the Grimethorpe Power Station to drive the turbo-compressor during start-up. During this period, it was intended that steam produced in the Facility Steam/Water Circuit would be vented to atmosphere and the required condensate make-up would be supplied from storage tanks. The Condensate Recovery System (CRS) and its interconnection with the Facility is shown. The resulting changes of the thermodynamic conditions of the steam are shown. The system is capable of receiving the full output of the Steam/Water Circuit at design conditions of 440°C, 30.3 bar abs.

37502 **(DOE/RA/50425—1) Singular perturbation methods and multimodel control.** (Michigan State Univ., East Lansing (USA)). Dec 1983. Contract AC01-80RA50425. 328p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84014046.

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In May of 1980 the Division of Electric Energy Systems of the US Department of Energy issued a Program Research and Development Announcement (PRDA) to solicit research proposals to conduct basic research on a wide range of issues needed to clarify and unravel the complexities of large scale system design and operation. This final report summarizes the results and conclusions of the research. The report is divided into five parts representing five different directions of research. Part one presents results on the stability and control of nonlinear singularly perturbed systems. Part two contains frequency domain results for systems with slow and fast modes. Part three deals with multirate and composite control of two-time-scale discrete-time systems. Part four presents a new approach for studying stochastic linear singularly perturbed systems and its application to multimodel control of stochastic systems. Finally, part five gives results on studying the interplay of singular perturbations and wide-band stochastic fluctuations in nonlinear systems. A brief summary of each part is given below.

37503 (EPRI-CS—3343, pp 11/1-11/47) **US water intake structures technology.** Mussalli, Y.G. (Stone and Webster Engineering Corp., Boston, MA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Fouling problems at intakes are discussed along with the status of water intake technology in the US, development work by the Electric Power Research Institute and the utility industry, and future developmental needs. Fouling problems are categorized by geographic location, type of foulant, affected system component, basic design, and pump type. Design advances made during the 1970s are surveyed, and areas of current exploration/development are discussed.

37504 (EPRI-CS—3343, pp 12/1-12/26) **Cooling water screens and pumps in French power plants.** Gauthier, H.; Simon, R.; Le Grand, A.; Jackson, P.E. Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

An overview of general design strategies and criteria for cooling systems in the EDF (Electricite de France) system is given. The components of cooling systems which are most throughly treated in the paper are debris screens and pumps. Design criteria for both are discussed in detail.

37505 (EPRI-CS—3343, pp 13/1-13/17) **Debris and shellfish filters.** Eimer, K.; Renfftlen, R. (TaproggembH, Dusseldorf, West Germany). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

The design of final filter systems which are used as supplements to bar screens and screen mesh are examined. The basic design feature of this final filter system is dependent upon turbulence induction, which backflushes the basket and allows reverse radial flows and carries debris to a discharge area. Design specifications for the filter system are presented, as are test results and economic analyses. Site-specific factors such as debris type, flushing method, and space limitations must be taken into account in order to maximize filter effectiveness.

37506 (EPRI-CS—3343, pp 21/1-21/18) **Effect of marine biofouling on the heat transfer performance of titanium condenser tubes.** Yamaguchi, Y.; Onda, K.; Sato, S.; Nosetani, T. (Chube Electric Power Co., Ltd., Kitasekiyama, Midoriku, Nagoya, Japan). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

A test facility was constructed to evaluate the heat transfer efficiency of titanium condenser tubes as compared with brass-aluminum ones. Very high rates (continuous) cleaning by carborundum balls was fairly useful for preventing titanium tubes from biofouling; on a longer term, the heat transfer performance of titanium tubes is comparable to that of aluminum brass tubes with weekly sponge ball cleaning. Continuous cleaning of the titanium tubes caused a corrosion rate of 0.3 to 0.4 μm/yr, which was negligible from a practical point of view.

37507 **(EPRI-NP—3559) Solubility of corrosive salts in dry steam. Final report.** Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). Jun 1984. 36p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920464.

Sodium chloride is one of the most common contaminants in thermal power systems using water and steam as a working fluid. Because many failures of steam turbine internals occur near the dry-to-wet transition (Wilson line), liquid-seeking impurities in the steam become suspected corrosive agents. It is useful to know how

much of various corrosive agents can arrive with the dry steam as dissolved species. This study has determined the concentration of sodium chloride that is dissolved (on a molecular, not particle, scale) in dry steam over the range of temperatures and pressures common to steam thermal electric power stations. An adsorption phenomenon of sodium chloride on the alloy Inconel 600 was discovered, making measurements of its steam solubility possible down to the level of parts per trillion (by weight). This phenomenon was also observed on type-304 stainless steel, indicating that it may be quite general for most system alloys.

37508 **(PB—84-182740) Synopsis of insulation problems at Yellowtail power plant.** Arbour, R.C. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Oct 1983. 20p. (REC-ERC—84-4). NTIS, PC A02/MF A01.

This report presents dissection results of a faulted portion of a coil from the power plant. Crona probe tests, failure analysis and theory of failure for groundwall and turn insulation are provided.

37509 **Modal analysis of synchronous machine dynamics.** Inan, M.K. (Univ. of California, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Circuits and Systems;* **CAS-29**: No. 10, 688-699(Oct 1982). Contract AC01-79ET29364.

A theory for the asymptotic modal decomposition of a linear multivariable feedback system subject to high gain output feedback has been developed and applied to the ideal synchronous machine by identifying the latter with such a high gain output feedback system. This new conceptualization leading to the asymptotic decoupling of machine modes brings a unified and rigorous understanding to synchronous machine dynamics. The numerical simulation runs show that the asymptotic decoupling approximation is highly accurate for a wide range of situations. 16 references, 10 figures, 2 tables.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 20020037108, 37113, 37117, 37118, 37119, 37120, 37503, 37907, 38467

37510 (EPRI-CS—3343, pp 2/1-2/10) **EPA regulations on chlorination and toxic coating: the impact on power plant operation.** Hogan, J.E. (Duke Power Co., Charlotte, NC). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

The major EPA regulations that affect macroinvertebrate control at steam electric plants are reviewed, covering BPT, BAT, NSPS, PSES, and PSNS. Some of the major changes from the previous rules are identified, as well as their impact on power plant operation. Some potential solutions are reviewed, stressing regulatory options.

37511 (EPRI-CS—3343, pp 1/1-1/10) **Condenser macrofouling control: the state of the art.** Diaz-Tous, I.A.; Miller, M.J. (Electric Power Research Inst., Palo Alto, CA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

An overview and review of the state of the art in condenser macrofouling control is presented. The economic and engineering factors underlying industry concern about condenser cooling system reliability are outlined, as are the actual internal effects of fouling. The paper also outlines the structure of the symposium for which it was the keynote address.

37512 (EPRI-CS—3343, pp 3/1-3/23) **Marine macrofouling.** Garey, J.F.; Burton, D.T.; Taft, E.P. (Marine Biocontrol Corp., Sandwich, MA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

A brief introduction to the mechanism of fouling and geographic distributions of the important marine macrofoulers is given. The life histories of these marine macrofouling organisms are reviewed with the intention of better understanding biofouling control strategies. The organisms examined include: barnacles, mussels, bryozoans, coelenterates, tunicates, tube worms, and algae.

37513 (EPRI-CS—3343, pp 5/1-5/15) **Impact of macrofouling on the heat rejection system.** Bell, R.J.; Diaz-Tous, I.A. (Heat Exchanger Systems, Inc., Boston, MA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Macrofouling has a significant impact on power plant heat rejection systems in terms of plant equivalent availability, unit heat rate and system operation maintenance cost. There are numerous devices and techniques for controlling macrofouling. The devices and techniques required are highly site specific and therefore should be selected and implemented carefully. A cost benefit analysis for the application of macrofouling control methods should be made for each unit. Guidance for these analyses is being provided by EPRI, through various projects and through this symposium.

37514 (EPRI-CS—3343, pp 6/1-6/11) **Microcosm monitoring mussel fouling.** Jenner, H.A. (N.V. KEMA, Arnhem, Netherlands). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

A microcosm has been designed to study fouling in cooling water circuits by the marine mussel Mytilus edulis and the freshwater mussel Dreissena polymorpha. The monitor can be considered as a bypass of the cooling water conduit and allows observation of mussel settlement and effectivity of the used antifouling agent. The main purpose of the monitor is to signal the appearance of mussel spat in the cooling water conduit. Until recently chlorination in seawater cooling systems was started when the temperature rose above 10°C. With help of the monitor, chlorination starting point can be delayed until spat is actually seen to settle. The yearly hypochlorite consumption thus could be reduced by 30% at the power station studied. The monitor can be used to test the effectiveness in general of antifouling paints, coatings and additives, but also to study such parameters as reproduction, growth rates and migration.

37515 (EPRI-CS—3343, pp 7/1-7/28) **Minimizing chlorine application consistent with effective macrofouling control: a pilot study of continuous, low level chlorination.** Morris, D.W.; Tackett, J.H.; Garey, J.F.; Egan, J.W. (Southern Co. Services, Inc., Birmingham, AL). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

During 1981 and 1982, a chlorine minimization study was performed at the Lansing Smith Station, a Gulf Power plant in the Southern electric system. As part of this study, artificial substrates and a sidestream test facility were employed in documenting the macrofouling problem and evaluating the effectiveness of various chlorination procedures. Based on the results of these tests, it may be concluded that a continuous chlorination program of 100 μg/l TRO is effective in preventing the attachment and growth of fouling organisms at the site. This amounts to a 25% savings in chlorine over other procedures. It was shown that intermittent chlorination actually aggravated fouling by oysters. The authors conclude that artificial substrates and sidestream facilities offer simple, effective means of assessing fouling problems and developing control procedures.

37516 (EPRI-CS—3343, pp 8/1-8/14) **Control by chlorination of fresh-water sponge fouling found in the vicinity of a nuclear power plant.** Rodgers, E.B.; Johnson, J.T. Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Fouling of condenser cooling systems by fresh-water sponges has been observed at sites in the Tennessee Valley Authority system. This study was designed to determine the 96-hour median lethal concentration of total residual chlorine and to assess the efficacy of chlorination procedures at Browns Ferry in eradicating adult fresh-water sponges in intake structures. The 96-hour median lethal TRC concentration was 0.15 mg/l with 95% fiducial limits of 0.07 and 0.25 mg/l.

37517 (EPRI-CS—3343, pp 9/1-9/18) **Cost of chlorination.** Kasper, J.R.; Chow, W.; Graham, J.; Mussalli, Y.G. (Stone and Webster Engineering Corp., Boston, MA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Chlorination has been the primary method of biofouling control used by utilities at steam electric generating stations. Chlorine is supplied by one of three basic types of systems: gaseous chlorination, on-site hypochlorite generation, and purchased sodium hypochlorite. Utilizing data from Edison Electric Institute and EPRI, patterns of chlorine use at US steam electric generating stations are examined. Equipment requirements for the three types of chlorination systems are examined and capital and operating cost curves are developed for each. By applying the developed costs to the chlorine utilization data, the total cost of chlorination to the US electric utility industry is estimated. It is estimated that the utility spends $27 million annually for biofouling control by chlorination. This translates to a figure of $100/yr/MW. This estimate may be somewhat conservative because the data base is at least three years old; and, since that time, some utilities have performed chlorine minimization programs. The costs of chlorination appear to be negligible as compared to the cost penalties associated with macrofouling and microbiological fouling problems.

37518 (EPRI-CS—3343, pp 10/1-10/11) **Effects of organotin anti-fouling coatings on marine organisms.** Sakaguchi, I.; Iitsuka, T.; Yasui, K. Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Organotin [bis(tri-n-butyltin)oxide] is experimentally evaluated as a biofouling control coating which can substitute for chlorination. It was found to be an effective biofouling control agent, and, in the system studied, did not have acute lethal effects on bioassay organisms in the environment. The authors acknowledge the efficacy of the compound as a fouling control agent, and recommend studies to assess accumulation of organotin in food chains.

37519 (EPRI-CS—3343, pp 14/1-14/14) **Borssele Nuclear Power Plant, The Netherlands: case history of condenser fouling problems and their solutions.** Romeijn, A.A. Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

In 1972, a 480 MW PWR powerstation was commissioned near Borssele, the Netherlands. The silt content of the estuarine cooling water often is high. Also, large mussel colonies develop near the pumping station during the summer months. Soon after start-up, condenser tube corrosion was noticed, mainly caused by under-deposit attack on the copper-nickel tube surface. Moreover, tube perforations were caused by erosion-corrosion around mussels having secured themselves inside tubes. Both the sedimentation of silt and the penetration of mussels were successfully prevented by the installation of Taprogge sponge ball cleaning systems and debris filters. With these, and the dosing of ferrous sulphate, the lifetime of the condensers was extended to almost ten years, a reasonable achievement under the circumstances. In 1982 the copper-nickel condensers were replaced by all-titanium condensers with welded tube-to-tubeplate joints. Operation with these new condensers is very satisfactory. The all-titanium condensers are completely tight and the debris filters are a great help in keeping mussels out of the system. The titanium tubes are kept very clean by the foamrubber cleaning balls. In fact, improved heat-transfer has resulted in an important increase in generated power production.

37520 (EPRI-CS—3343, pp 16/1-16/20) **West German experience on fouling-control and measurement methods.** Zoerner, W.E.; Scheurlen, J.M. (Kraftwerk Union AG, Erlangen, West Germany). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

The fouling control methods employed by Kraftwerk Union AG, in West German power plants are examined. Intake structure design is oriented around the use of closed circuits rather than open culverts, and pipework is kept as short as possible. Mechanical cleaning of the water is accomplished using bar screens, fine-mesh screens and travelling screens. Condenser tube fouling is controlled by using Taprogge (Amertap) sponge ball systems and turbulence induction filters. Chlorine, toxic coatings and backwashing are little used by this company.

37521 (EPRI-CS—3343, pp 17/1-17/16) **Marine macrofouling control experience in the UK with an overview of European practices.** Whitehouse, J.W.; Khalanski, M.; Saroglia, M. (Central Electricity Generating Board, Leatherhead, England). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Macrofouling control experiences at power stations in England, France, and Italy are summarized. At Sizewell, in England, fouling by mussels was severe. It was found that the station was located in a prime mussel settlement area, and that chlorination must be done on a one-month-on, one-month-off regime. At Hinkley, mussel settlement is not a major problem and chlorination is not needed to the same degree as at Sizewell. The experience at coastal facilities in France and Italy leads to the same basic conclusions as the British experiences: that site-specific ecological considerations (which fouling organisms are present, and at what density) strongly determine which fouling control strategies must be used.

37522 (EPRI-CS—3343, pp 18/1-18/13) **Control of mussel fouling in The Netherlands: experimental and existing methods.** Jenner, H.A. (N.V. KEMA, Arnhem, Netherlands). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Settlement and growth of the marine mussel Mytilus edulis and, to a lesser extent, the freshwater mussel Dreissena polymorpha causes problems in cooling water systems. Usually, fouling is prevented by chlorination. Due to growing environmental concern, this research was carried out, mainly focused on Mytilus, to find new physical and chemical control methods. Physical antifouling methods, such as acoustics and sedimentation, offer no hope. Non-toxic antifouling coatings, such as foams, need to be further investigated, especially with respect to settlement behaviour of spat and long-term resistance to seawater. Heat treatment, killing all fouling organisms by recirculation of heated cooling water, proved to be successful both in laboratory experiments and in plant-scale experiments. In freshwater cooling systems one treatment a year (35°C during 1 hour) and in seawater 3-4 treatments a year (38°C during 1 hour) will be effective. Continuous and discontinuous chlorination at low levels (≥ 0,3 mg/l free available halogen) does not prevent settlement of Mytilus. The growth rate, however, is strongly reduced and they tend to release themselves after several months. Fouling is not prevented but maintained at a manageable level. Dreissena is much more susceptible to chlorination. All settled mus-

sels will be killed by a 2-3 week continuous chlorination at the end of the reproductive season.

37523 (EPRI-CS—3343, pp 19/1-19/21) **Antifouling coatings: potential for controlling macrofouling in operating coastal power plants.** Holl, C.H.; Martin, R.L.; Hillman, R.E. (Stone and Webster Engineering Corp., Boston, MA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

A recent approach to controlling macrofouling involves the adaptation of shipbottom antifouling materials to circulating water system applications. Materials currently used to maintain shipbottoms include copper-nickel alloys, copper oxide-based coatings, non-toxic coatings, organotin coatings, and rubber sheeting. These materials are surveyed, with greatest emphasis on organotin coatings. These coatings consist of organic tributyl groups chemically bound to inorganic tin molecules. The EPA has not yet established limits on the use of organotin compounds in power plant applications. The coatings work by releasing toxicant by leaching; this is an exponential decay function. An extensive test program is currently underway and is being sponsored by EPRI.

37524 (EPRI-CS—3343, pp 20/1-20/17) **Cathelco system to control fouling.** Sziladi, L.L.; Bailey, D.; Liden, L.H. (Potomac Electric Power Co., Washington, DC). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Potomac Electric Power Company has built a test facility to examine the Cathelco system as a fouling controller at the Chalk Point complex in Prince George's County, Maryland. The Cathelco system consists of a control panel which contains an anode made (in this case) of copper and another anode of aluminum. The integration of these anodes forms a cupro-aluminum floc which is the actual protective agent. After testing, it was concluded that the system was only marginally effective and was not cost-effective. the company did not install a full scale system.

37525 (EPRI-CS—3343, pp 22/1-22/6) **Velocity vs settling success of macroinvertebrates.** Yasui, K.; Kawabe, A.; Sakaguchi, I.; Aoki, K.; Fukuhara, K. Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Experiments were carried out to examine the relationship between settling success in barnacles and flow rate in pipes, measured 1 mm from the pipe wall. It was found that the upper limit near-wall velocity was 0.8 m/s. The relationship between settling success in mussels could not be determined. Preliminary findings indicate a lower velocity limit than for barnacles. Attachment rates for slime organisms decreased logarithmically with increase in current velocity.

37526 (EPRI-CS—3343, pp 23/1-23/42) **Control of macrofouling in Japan: existing and experimental methods.** Kawabe, A. Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Macrofouling control in Japan is discussed and control technologies that are being used or investigated are outlined. Japanese experience with jellyfish, molluscs, barnacles, annelids, and algae are recounted. Control technologies including chlorine, ozone, hydrogen peroxide, copper and copper alloys, antifouling paint, sound propagation, filters, screens, and ball-type cleaners are all reviewed. The basic conclusion reached by the author is that for substantive progress with this problem to occur, the settling mechanism in fouling organisms must come to be understood.

37527 (EPRI-CS—3343, pp 4/1-4/30) **Freshwater macrofouling and control with emphasis on Corbicula.** Mattice, J.S. (Electric Power Research Inst., Palo Alto, CA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Condenser cooling system fouling by the Asiatic clam, Corbicula, is discussed. Corbicula (1) has an early life history stage which is subject to long range transport, is small, and has a byssus for attachment, (2) grows rapidly to fouling size, (3) matures at an early age, (4) is fecund, (5) feeds by filtering particles from the water and (6) can isolate itself from the environment by closing its shell so that it can survive relatively long exposure to pernicious environmental conditions or toxicants. These characteristics enhance its fouling ability. Fouling control has been attempted using physical/mechanical and chemical techniques, but no foolproof combination has been developed. Evidence also suggests that biological techniques (e.g., control by pathogens) may have some potential for development. Ultimate control of the clams may involve a blend of all three techniques, following Integrated Pest Management strategies developed for agriculture.

37528 (EPRI-CS—3612-Vol.1) **FGD chemistry and analytical methods handbook. Volume 1. Process chemistry - sampling, measurement, and laboratory guidelines. Final report.** Smith, T.P. (Radian Corp., Austin, TX (USA)). Jul 1984. 206p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920449.

The overall purpose of this handbook is to provide a comprehensive guide to sampling, analytical, and physical test methods essential to the operation, maintenance, and understanding of flue gas desulfurization system chemistry. The Electric Power Research Institute sponsored compilation of the three-volume manual in response to the needs of electric utility personnel responsible for establishing and operating commercial FGD analytical laboratories. Volume 1 of the handbook explains FGD system chemistry in the detail necessary to understand how the processes operate and how process performance indicators can be used to optimize system operation. Volume 2 includes 54 physical testing and chemical analysis methods for reagents, slurries, and solids, and information on applicability of individual methods to specific FGD systems. Volume 3 contains instructions for an FGD process chemistry computer program designated by EPRI as FGDLIQEQ. Executable on IBM personal and mainframe computers, this program calculates the concentrations (activities) of chemical species (ions) in scrubber liquor and can calculate driving forces for important chemical reactions such as SO_2 absorption and calcium sulfite and sulfate precipitation. This program and selected chemical analyses will help an FGD system operator optimize system performance, prevent many potential process problems, and define solutions to existing problems. 22 references, 16 figures, 26 tables.

37529 **Technology status of particulate removal from high-temperature high-pressure combustion gases.** Saxena, S.C.; Henry, R.F.; Podolski, W.F. (Argonne National Lab., IL). *Aerosol Science and Technology;* **1**: 235-257(1982).

The adoption of coal-fired pressurized fluidized-bed combined-cycle combustion systems by utilities for electric power generation depends to a large extent on the development of an efficient and economic cleanup system between the combustor and gas turbine. To accomplish particulate removal from a dust-laden gas stream, a number of separation devices have been developed. These include conventional and augmented cyclones; porous metal, fabric, and ceramic membrane filters; fixed-, continuously moving-, and fluidized-bed granular filters; electrostatic precipitators; as well as several other novel separation devices. The results of tests of these devices are discussed in relation to pressurized fluidized-bed combustion applications.

2003 Power Transmission And Distribution

37530 **(DOE/ET/29073—T1) Advanced concepts for a 1200-kV shunt reactor. Volume I. Exploration of new concepts for inductive shunt reactor designs for integration into a 1200-kV gas insulated substation. Final report.** (Westinghouse Electric Corp., Muncie, IN (USA). Large Power Transformer Div.). 27 Mar 1981. Contract AC01-78ET29073. 443p. NTIS, PC A19/MF A01; 1; GPO Dep. Order Number DE84015033.

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The objective of this program is to explore new concepts for inductive shunt reactor designs for integration into a 1200 kV gas insulated substation. The most promising design should exhibit low dimensional profile with reduced weight, lower losses, and lower noise level when compared with units of equivalent rating designed with present day technology. To meet the objectives several advanced concepts of shunt reactor design were studied. The major concepts explored in this project reactor design were studied. The major concepts explored in this project included: sulfur hexafluoride gas insulated, foil type windings, high reluctance core materials, and heat transfer via the gaseous medium. As a result of the study, a shunt reactor was designed through an application of the advanced concepts with the conclusions that the program objectives could be attained.

37531 **(EPRI-EL—3592-CCM) Transmission line design optimization: TLOP manuals.** Grant, I.S.; Clayton, R.E.; Scott, G.E. (Power Technologies, Inc., Schenectady, NY (USA)). Jun 1984. 669p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920502.

The transmission line optimization project has the goal of developing innovative optimization techniques for 115 to 500 kV transmission lines to optimize the interdependent electrical, environmental, and structural design parameters with respect to such factors as initial or lifetime cost, electric field strength, and right-of-way requirements. Version 1.2 of the Transmission Line Optimization Program (TLOP) is an initial product from the project. In its present form, TLOP provides economic optimization for all combinations of user-specified values, major variables being structure type, span length, and conductor system. This version of the program also provides a number of design capabilities as subprograms such as radio/audible noise, sag tension, and conductor temperature and allows a sensitivity analysis of the solution to varying data assumptions. Future editions of the program will have additional features, including expansion of the present graphics output capabilities. This volume contains the four program manuals: the application guide, the user's manual, the program reference manual, and the data base manual.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 21000037222

37532 **(DOE/NE—0048/6) UPDATE: Nuclear Power Program information and data, January-March 1984.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Converter Reactor Deployment). Jun 1984. 148p. (PB—84-911501). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015420.

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UPDATE is published to provide a quick reference source on the current status of nuclear powerplant construction and operation in the United States and for information on the fuel cycle, economics, and performance of nuclear generating units. Similar information on other means of electric generation as related to nuclear power is included when appropriate. UPDATE is intended to provide a timely source of current statistics, results of analyses, and programmatic information proceeding from the activities of the Office of Nuclear Energy and other components of the Department of Energy, as well as condensations of topical articles from other sources of interest to the nuclear community.

37533 **(EPRI-NP—3416) Guide for developing preventive maintenance programs in electric power plants. Final report.** Perla, H.F.; Sattison, M.B.; Stampelos, J.G.; Gekler, W.C. (Pickard-Lowe and Garrick, Inc., Irvine, CA (USA)). May 1984. 232p. EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920396.

This project was initiated in response to expressed requirements by a number of utilities for a method to guide the scoping of a cost-effective preventive maintenance program for power plants. A guide was prepared and workshops were held to present the model reflected in the guide for developing a PM program. The model includes the identification of critical equipment items to be considered, the establishment of potential scope and frequency with which PM activities should be performed on this equipment, and the presentation of methods to perform cost/benefit and program optimization analyses consistent with the utility's level of resource commitment to PM. The guide also indicates the manpower requirements for developing a PM program using the model by skill level and number.

37534 **(NUREG—0020-Vol.8-No.5) Licensed operating reactors. Status summary report data as of April 30, 1984. Volume 8, No. 5.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jun 1984. 378p. NTIS, PC A17/MF A01 - GPO*. Order Number TI84901551.

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This report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Resource Management from the Headquarters staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. The three sections of the report are: monthly highlights and statistics for commercial operating units, and errata from previously reported data; a compilation of detailed information on each unit, provided by NRC's Regional Offices, IE Headquarters and the utilities; and an appendix for miscellaneous information such as spent fuel storage capability, reactor-years of experience and non-power reactors in the US.

37535 **(NUREG—0040-Vol.8-No.2) Licensee contractor and vendor inspection status report. Quarterly report, April-June 1984. Vol. 8, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Jul 1984. 435p. NTIS, PC A19/MF A01 - GPO*. Order Number TI84901745.

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A fundamental premise of the Nuclear Regulatory Commission's (NRC) nuclear facility licensing and inspection program is that a licensee is responsible for the proper construction and safe operation of nuclear power plants. The total government-industry system for the inspection of nuclear facilities has been designed to provide for multiple levels of inspection and verification. Licensees, contractors, and vendors each participate in a quality verification process in accordance with requirements prescribed by, or consistent with, NRC rules and regulations. The NRC inspects to determine whether its requirements are being met by a licensee and his contractors, while the great bulk of the inspection activity is performed by the industry within the framework of sequential ongoing quality verification programs. The White Book contains information normally used to establish a qualified suppliers list; however, the information contained in this document is not adequate nor is it intended to stand by itself as a basis for qualification of suppliers.

37536 **(NUREG/CR—3520-Vol.2) Long-term research plan for human factors affecting safeguards at nuclear power plants. Volume II. Development of detailed analyses.** O'Brien, J.N.; Fainberg, A.; Mazur, A.; Arenson, S.; Katzer, J.; Settel, B. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 204p. (BNL-NUREG—51718-Vol.2). NTIS, PC A10/MF A01 - GPO. Order Number TI84014972.

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This report presents a long-term research plan for addressing human factors which can adversely affect safeguards at nuclear power plants. It was developed in order to prioritize and propose

research for NRC in regulating power plant safeguards. Topics discussed include: identification and ranking of human factors affecting safeguards at nuclear power plants; human factors in material control and accounting; feasibility of research approaches for examining human factors related to power reactor safeguards; a review of research designs for reactor safeguards; and a description of nuclear power plant safeguards, regulatory requirements, and industry standards.

37537 (ORAU—227) Occupational employment in nuclear-related activities, 1983. Baker, J.G.; Olsen, K. (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1984. Contract AC05-76OR00033. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015054.

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This report examines 1983 occupational employment in nuclear-related activities including activities by businesses in the fuel cycle, by utilities, by vendors, by supporting services, and by research and development (R & D) organizations. This report provides a descriptive profile of 1983 employment and comparisons to nuclear-related employment in previous years.

37538 (SAND—84-0286C) Coordinated approach to nuclear power plant design. Olascoaga, M.T.; Winblad, A.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 5p. (CONF-840734—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014957.

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

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An approach to the design of a nuclear power plant that coordinates operations, safety, and security requirements is presented. A number of steps in the approach are identified. Construction features, equipment, and procedural elements that must be considered in a coordinated, standardized design are identified. An example of a design concept that meets some of these requirments is described.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 21010037608, 37609, 37615, 37641, 37645, 37662, 37666, 37669, 37670, 37675, 37689, 37694, 37695, 37696, 37697, 37698, 37699, 37701, 37702, 37703, 37704, 37705, 37706, 37707, 37708, 37709, 37713, 37714, 37715

37539 (AA-TR-KM—83-192) SCC Testing of Bolt Materials in BWR Environment. Final Report. Ljungberg, L.; Korhonen, S. (ASEA-ATOM AB, Vaesteraas (Sweden)). May 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701578.

Bolts of SS 2570 (A286) in ASEA-ATOM internal main circulation pump reactors have experienced extensive intergranular stress corrosion cracking (IGSCC). An in-reactor experiment has been run to demonstrate if other bolt materials used in ASEA-ATOM reactors, solution annealed SS 2343 (type 316 SS) and Incoloy 800, are unsensitive to IGSCC. One week CERT testing was performed in a loop in Ringhals 1 with SS 2570, SS 2343 and Incoloy 800 in two conditions, one representing as-installed bolts and one the same after 40 years ageing at full reactor temperature. Electrochemical potentials were monitored during test for characterization of the reactor environment. It was demonstrated that SS 2343 and Incology 800 in bolt applications are unsensitive to IGSCC under full temperature BWR conditions. IGSCC sensitivity of SS 2570 was verified. A transient including high reactor water conductivity occurred during the test.

37540 (AEEW-R—1707) WIMS-E modules W-PRES and W-RES. Roth, M.J. (UKAEA Atomic Energy Establishment, Winfrith). Oct 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702569.

The WIMS-E modules W-PRES and W-RES produce cross sections corrected for the effects of resonance absorption in complicated geometries. They can do this in any geometry for which collision probabilities can be calculated, and hence supplement the WIMS-E module W-HEAD which is limited to one dimensional slab or annular geometry. Resonance interaction may be taken into account for a mixture of resonance absorbers. However, it is convenient and usually adequate to calculate most resonances in W-HEAD and only the U-238 absorption resonances in W-RES. This report describes the method used and the data requirements of the programs.

37541 (AEEW-R—1710) User's guide to the WIMS-E module W-CACTUS. Halsall, M.J. (UKAEA Atomic Energy Establishment, Winfrith). Nov 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702570.

CACTUS is a code that solves the multigroup neutron transport equations using a characteristics method. This is a numerical approach in which the differential form of the Boltzmann equation is integrated along explicit tracks through the geometry and the neutron flux is obtained by a summation of the contributions made by a selected sample of such tracks. This report describes the theory very briefly, and concentrates on providing the information required to use the program.

37542 (CONF-840614—91) Calculation of limit cycle amplitudes in commercial boiling water reactors. March-Leuba, J.; Perez, R.B.; Cacuci, D.G. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014263.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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This paper describes an investigation of the dynamic behavior of a boiling water reactor (BWR) in the nonlinear region corresponding to linearly unstable conditions. A nonlinear model of a typical BWR was developed. The equations underlying this model represent a one-dimensional void reactivity feedback, point kinetics with a single delayed neutron group, fuel behavior, and recirculation loop dynamics (described by a single-node integral momentum equation).

37543 (DOE/NE—0030/11) US central station nuclear electric generating units: significant milestones. Status as of January 1, 1984. (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Converter Reactor Deployment). Jul 1984. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015230.

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A revised listing of significant milestones for U.S. nuclear power plants is presented. Information includes: plant name; owners; electric power capacity; type of reactor; contractor; public announcement date; order date; construction permit and operation license dates; initial criticality date; power generation date; and commercial operation date.

37544 (EIR—469) LWR-core behaviour project. Position at end 1981. Paratte, J.M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jul 1982. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701575.

The LWR-Core behaviour project concerns the mathematical simulation of a light water reactor in normal operation (emergency situations excluded). Computational tools are assembled, i.e. programs and libraries of data. These computational tools can likewise be used in nuclear power applications, industry and control applications. The project is divided into three parts: the development and application of calculation methods for quantisation determination of LWR physics; investigation of the behaviour of nuclear fuels under radiation with special attention to higher burnup; simulation of the operating transients of nuclear power stations.

37545 **(EPRI-NP—3528) Requirements and guidelines for evaluating component support materials under unresolved safety issue A-12. Final report.** Cipolla, R.C.; Grover, J.L.; Hayes, D.J.; Egan, G.R. (Aptech Engineering Services, Inc., Palo Alto, CA (USA)). Jun 1984. 313p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920458.

Unresolved Safety Issue A-12 is a Nuclear Regulatory Commission (NRC) activity which addresses the potential for low fracture toughness properties of component support materials. The resolution for this generic activity was embodied in NUREG-0577 and subsequent amendments. Also included in the original proposed procedures for resolution was the concern for stress corrosion cracking (SCC) degradation of high strength materials, particularly bolting materials. The purpose of this project was to interrogate the requirements of the proposed NRC procedures in view of their potential impact on existing plants. The work performed and documented in this report includes a detailed review of the NRC proposed procedures, independent assessment of the important aspects of the A-12 issue, and a development of a set of evaluation procedures and criteria based on fracture mechanics to be used as an alternative method to the approach proposed by the NRC. In addition, an improved method for evaluating the potential for SCC in high strength materials was developed.

37546 **(EPRI-NP—3555) User's guide for the Columbia University-EPRI Critical Heat Flux DATATRAN Data Base.** House, R.K.; Cordes, G.A. (Intermountain Technologies, Inc., Idaho Falls, ID (USA)). Jul 1984. 129p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920447.

Critical heat flux data gathered at the Columbia University Heat Transfer Research Facility for 235 fuel rod test sections representing nine different sponsors have been uniformly formatted and entered into a data base using the DATATRAN 2.2 system. The data base and the DATATRAN modules which can be used to access and analyze the data are described. Examples are given showing how the DATATRAN modules can be used to generate listings, plots and curve fits of the data in the data base.

37547 **(EPRI-NP—3568) Quad cities nuclear and fuel performance measurements. Final report.** Crowther, R.L.; Hopkins, G.C.; Kosanke, H.D.; Ogawa, S.Y.; Rose, P.C.; Shiraishi, L.M.; Yang, R.L. (General Electric Co., San Jose, CA (USA). Nuclear Fuel and Special Projects Div.). Jul 1984. 241p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920473.

This report summarizes the EPRI-sponsored Fuel Performance Program (Contract RP 497-1), which began in the early 1970's and extended through eight years of fuel irradiation in the Quad Cities-1 reactor. The program obtained carefully regulated high burnup irradiation data on Boiling Water Reactor uranium, gadolinium and mixed oxide (both annular and solid pellet) fuels. Four high power fuel assemblies located at the core center and one peripheral low power reference fuel assembly were irradiated to peak burnup levels of approximately 57,000 MWd/MT, and a peak power level of approximately 15.5 kW/ft. Measurements performed and summarized in this report include: detailed global gamma scans and local pin-by-pin gamma scans through five cycles of irradiation; the measurement of neutron fast and thermal flux distributions for local, simulated one stuck control rod cold criticals; both axial and radial mass spectrometric measurements; fuel rod neutrographs completed at the site; end-view neutrographs completed on partially depleted gadolinia pellets; channel bulge, bow, flatness, displacement and nondestructive inspections; rod length measurements; and fission-gas release measurements after two different cycles of irradiation.

37548 **(EPRI-NP—3569) Evaluation of nuclear power plant standardization concepts. Final report.** Schmitz, R.P.; McDonnell, T.R. (Bechtel Group. Inc., San Francisco, CA (USA)). Jun 1984. 113p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920450.

This report is intended as an aid in communicating and understanding the many facets of nuclear plant standardization. The present design process is described and the impact of important variables on the design process is presented in a series of 55 matrices. The potential impact of future licensing decisions and technological evolution is discussed. Alternative standardization approaches are evaluated.

37549 **(EPRI-NP—3570) Significance of lamellar tearing in structural steels. Final report.** Grover, J.L.; Cipolla, R.C. (Aptech Engineering Services, Inc., Palo Alto, CA (USA)). Jun 1984. 66p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920460.

Lamellar tearing is a commonly occurring fabrication-related defect. As a result, there exists a need to determine the significance of lamellar tears on structural integrity. This report reviews the phenomenon of lamellar tearing in an attempt to determine the strength of a welded joint that contains lamellar tears. Design considerations useful in preventing the occurrence of lamellar tearing are also reviewed. Predictive models are developed and compared with experimental data of weldments containing lamellar tears. None of the predictive models was able to describe adequately the failure behavior of the lamellar-torn joints. However, a modified limit-load criterion was developed that can be used to assess conservatively the structural integrity of a joint containing lamellar tears.

37550 **(EPRI-NP—3590) Transport theory analysis of the neutron noise in BWRs.** Kosaly, G.; Sanchez, R. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). Jun 1984. 98p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920466.

Using the correlation of the fluctuating signals of in-core neutron detectors located in the same instrument guide tube one can measure the void-propagation velocity in the bundles. Since the instrument guide tubes are located in the bypass region between four bundles, the neutron detector sees the void-fraction fluctuations in different regions of the neighboring bundles with different weights. Neutron transport theory methods were used to evaluate the weight-function that determines the signal contribution of disturbances acting at different spatial regions. The weight function results have been combined with subchannel predictions to evaluate the cross-spectrum between two in-core detectors.

37551 (IWGFPT—17, pp 82-90) **Model experiments of crud deposition on the surface of Zircaloy at high temperature.** Ishigure, K.; Kawaguchi, M. (Tokyo Univ. (Japan). Faculty of Engineering). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The deposition of crud particles on Zircaloy fuel surfaces is very important in the activity build-up process in the primary coolant systems of LWR. There have been several works on this subject, but the mechanism is still not well understood with some inconsistency in the data obtained so far. In this work the experiments were carried out using "mono-disperse" hematite particles with narrow particle size distribution as model crud to investigate the deposition process on the boiling surfaces at high temperature. The effects of several factors such as crud concentration, heat flux, crud particle diameter and pH were examined, and the experimental results were explained on the basis of the theoretical consideration on the electrokinetic interaction between the crud particle and the surface.

37552 (IWGFPT—17, pp 97-106) **Control of feedwater composition of BWR power plant.** Sturla, P. (Laboratorio Centrale, Ente Nazionale per l'Energia Elettrica, Piacenza (Italy)); D'Anna, A. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)); Borgese, D. (Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Corrosion behaviour of fuel element cladding, cycle structural materials and dose rate increase are relevant to physico-chemical characteristics of process coolants and to adopted operational conditions. A careful control of cycle chemistry, during loading and shutdown periods, is necessary to verify material choices, the polishing system and chemistry specifications. For this purpose ENEL carried out some preliminary experimental tests employing continuous control system and samples for specific analytical determinations. The cycle points checked during about two months were: main condensate; condensate after polishing system; outlet of low pressure heaters; final feedwater; inlet and outlet of clean-up system; drains to condenser. The physico-chemical analysis were related to corrosion product levels (Cu, Fe, Ni, Co) and water chemistry (pH, conductivity, dissolved oxygen etc.). The preliminary results allow to express some considerations about sampling procedures, detection limits and reliability of analytical employed methods. The acquisition data time and some morphological oxide pictures are also shown.

37553 (IWGFPT—17, pp 107-118) **Fuel deposits and water chemistry at TVO I power station during the first three fuel cycles.** Silvennoinen, S.; Hakala, J. (Industrial Power Company Ltd., Olkiluoto (Finland)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

TVO 1 is a 660 MWe direct-cycle, light-water cooled BWR of Asea-Atom design. The unit has just completed the 4th cycle. Sampling of deposits on fuel surfaces has been performed by Asea-Atom after each cycle. The deposits consist mainly of iron (78-86%) excepting two rods in a bundle belonging to the first reload. On these two rods the amounts of Cr and Cu were exceptionally high indicating differences in the deposition processes between the initial fuel and the first reload. In general the crud thickness is highest at a height of 1 to 1.5 meters from the bottom plate of the bundle. The average concentrations of the corrosion products vary from 3.6 to 10.3 g/m^2/bundle. Inexplicable large variations of the crud amount between the bundles and between the individual rods in a bundle have been measured. Growth rate of deposits is decreased and water chemistry is improved with improved operation of the plant. During normal operation many impurities are below the detection limit thus making the interpretation of the results difficult.

37554 (IWGFPT—17, pp 119-121) **Condensate treatment in BWR circuits by filter demineralizer units using powdered ion exchange resin at medium and high temperature.** De Martino, R. (Interwat, Idreco Process, Voghera (Italy)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Considering the radiation build-up in some BWR reactors, we make a correlation between this phenomenon and the condensate purification system applied and the point of its utilization into the circuits. The application temperature of such a plant seems to have a very important role on the equilibria of metals contained in the reactor water and on the oxide composition. The efficiency of the condensate polishing system and the corrosion control are the most interesting objectives to achieve and to maintain, to control and regulate the physical and chemical process in the feedwater and in the reactor water. Up to date the technology owns major knowledge and a consistent know-how on using chemical products in order to increase the condensate polishing system efficiency. It is also considered a typical parallel case of a conventional power station and a secondary system of BWR units.

37555 (IWGFPT—17, pp 9-16) **KWU-results on waterside corrosion of Zircaloy in PWRs and BWRs.** Garzarolli, F.; Loeh, I.; Stehle, H.; Steinberg, E. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)); Edeling, M. (Siemens A.G., Erlangen (Germany, F.R.)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The incentive to increase the design burnup of LWR fuel has again initiated research on the waterside corrosion of the Zircaloy cladding. Thereby it has to be considered that the corrosion rate of Zircaloy increases with increasing temperature at the metal/oxide interface, and thus the temperature raise over the growing oxide may have a certain "feed-back" effect. The in-reactor corrosion of Zircaloy is significantly influenced by the oxygen content of the coolant. In PWRs, where oxygen is suppressed by hydrogen addition, the corrosion rate was found to be the same as out-of-reactor up to an oxide thickness of 2 to 5 μm. At a higher thickness the corrosion rate is enhanced. In BWRs, under oxiginated conditions, the corrosion is enhanced especially early in time. Furthermore, a localized corrosion phenomenon, the so-called nodular corrosion, is often found after exposures of >100-400 EFPD. Lot to lot - and reactor to reactor - variations were observed in both, PWRs and BWRs. For mechanistic studies, electron microscopic investigations, impedance, surface area and porosity measurements have been performed on oxides from various sources.

37556 (IWGFPT—17, pp 17-34) **Study on the influence of water chemistry on fuel cladding behaviour of LWR in Japan.** Mishima, Y. Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

This article presents the results of the study on the influence of water chemistry on fuel cladding behaviour, which has been performed for more than ten years on BWRs and PWRs in Japan. The post irradiation examination (P.I.E.) program of commercial reactor fuel assembly which was explained at Tokyo meeting in 1981 includes an investigation of the characteristics and build-up conditions of crud deposited on mainly BWR fuel cladding. This article also provides a summary of the results of the investigation and shows how the results are utilized for establishing effective water chemistry measures.

37557 (IWGFPT—17, pp 55-72) **Observations of crud deposits, corrosion and erosion of BWR and PWR fuel.** Bairiot, H. (Societe Belge pour l'Industrie Nucleaire, Brussels); Regge, P. de (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The BWR experience is limited to one reactor but the PWR experience covers a wide range of successive generations of power plants (7 in total). The systems are described and their water chemistry briefly commented. Some R and D performed on the effects of the operating regimes (steady state and transients) are summarized. Observations made by pool-side inspections and postirradiation examinations of fuel are outlined concerning water chemistry effects (crud deposits and corrosion) and "mechanical" coolant-cladding interaction (chip deposits and baffle jetting).

37558 (NUREG/CR—3520-Vol.1) **Long-term research plan for human factors affecting safeguards at nuclear power plants. Volume 1. Summary and users' guide. Vol. 1.** O'Brien, J.N.; Fainberg, A. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 41p. (BNL-NUREG—51718-Vol.1). NTIS, PC A03/MF A01 - GPO. Order Number TI84014971.

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This report presents a long-term research plan for addressing human factors which can adversely affect safeguards at nuclear power plants. It was developed in order to prioritize and propose research for NRC in regulating power plant safeguards. Research efforts addressing human factors in safeguards were developed and prioritized according to the importance of human factors areas. Research was also grouped to take advantage of common research approaches and data sources where appropriate. Four main program elements emerged from the analysis, namely (1) Training and Performance Evaluation, (2) Organizational Factors, (3) Man-Machine Interface, and (4) Trustworthiness and Reliability. Within each program element, projects are proposed with results and information flowing between program elements where useful. An overall research plan was developed for a 4-year period and it would lead ultimately to regulatory activities including rulemaking, regulatory guides, and technical bases for regulatory action. The entire plan is summarized in Volume 1 of this report.

37559 **(NUREG/CR—3825-Vol.1-2) Acoustic emission/flaw relationship for in-service monitoring of nuclear pressure vessels. Quarterly report, October 1983-March 1984. Volumes 1 and 2.** Hutton, P.H.; Kurtz, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 42p. (PNL—5125-Vol.1-2). NTIS, PC A03/MF A01 - GPO $4.00. Order Number DE84015039.

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This report describes technical progress on a program to apply acoustic emission for continuous integrity surveillance of nuclear reactor pressure boundaries. The period is October 1983 to March 1984. Test data from the completed intermediate scale vessel (ZB-1) test is being analyzed to isolate AE from crack growth for the purpose of refining AE signal identification and AE interpretation methods. Fatigue crack growth in the ZB-1 vessel is being characterized by destructive examination. Acoustic data obtained from the No. 2 inlet nozzle during hot functional testing at Watts Bar Unit 1 reactor showed a source concentration. A cooperative effort between TVA and PNL is planned to evaluate the significance of the data. Identification of crack growth AE by pattern recognition is showing much improved results. Fatigue testing of A106B ferritic pipe material is showing mixed AE results related to previous relationships developed for A533B steel. Development of an ASTM Standard Practice for continuous AE monitoring of pressure boundaries has been initiated. A NUREG document on results from AE monitoring at Watts Bar, Unit 1 reactor during hot functional testing has been completed.

37560 **(NUREG/CR—3840) Cost analysis for potential modifications to enhance the ability of a nuclear plant to endure station blackout.** Clark, R.A.; Riordon, B.J.; Thomas, W.R.; Watlington, B.E. (Science and Engineering Associates, Inc., McLean, VA (USA); Mathtech, Inc., Arlington, VA (USA)). Jul 1984. 167p. NTIS, PC A08/MF A01 - GPO* $5.50. Order Number TI84901746.

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Cost estimates were required to serve as partial bases for decisions on four potential nuclear reactor facility modifications being considered in the resolution of US1 A-44, Station Blackout. The modifications constituting the four Subtasks in this report are: increasing battery capacity; adding an AC-independent charging pump for reactor coolant seal injection; increasing condensate storage tank capacity; and increasing compressed air supply for instrument air. Science and Engineering Associates, Inc., established the engineering requirements for the facility modifications; MATHTECH, Inc., supported the effort by estimating costs related to those modifications. The cost estimates contained in this report include those for the following: engineering and design; equipment, material, and structures; installation; and present worth of the annual operation and maintenance over the remaining useful life of the reactor. In addition to providing engineering requirements for the four modifications, SEA, Inc., evaluated the potential for synergistic solutions.

37561 **(PNL—5201) Review and evaluation of Transamerica Delaval, Inc., diesel engine reliability and operability: Grand Gulf Nuclear Station Unit 1.** (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 51p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84015283.

PNL and its consultants conclude that the TDI diesel engines at the GGNS have the needed operability and reliability to fulfill their intended (auxiliary) emergency power function for the first refueling cycle. This conclusion is reached with a number of understandings regarding limits to the engine requirements, NRC concurrence with MP and L findings/conclusions regarding items to be supplied to NRC, limitations on the engine Brake Mean Effective Pressure (BMEP), and MP and L's implementation of the modifications to their proposed surveillance and maintenance program.

37562 **Analysis of cracked core spray piping from the Quad Cities unit 2 boiling water reactor.** Diercks, D.R.; Gaitonde, S.M. (Argonne National Laboratory Argonne, IL). pp 136-146 of Materials in nuclear energy. Metals Park, OH; American Society for Metals (1982). (CONF-8209200—).

From ASM Canadian Council and Canadian Nuclear Society conference on materials in nuclear energy; Huntsville, Canada (29 Sep 1982).

The results of a metallurgical analysis of leaking cracks detected in the core spray injection piping of Commonwealth Edison Company's Quad Cities Unit 2 Boiling Water Reactor are described. The cracks were present in a welded 105° elbow assembly in the line, and were found to be caused by intergranular stress corrosion cracking associated with the probable presence of dissolved oxygen in the reactor cooling water and the presence of grain boundary sensitization and local residual stresses induced by welding. The failure is unusual in several respects, including the very large number of cracks (approximately 40) present in the failed component, the axial orientation of the cracks, and the fact that at least one crack completely penetrated a circumferential weld. Virtually all of the cracking occurred in forged material, and the microstructural evidence presented suggests that the orientation of the cracks was influenced by the presence of axially banded delta ferrite in the microstructure of the forged components.

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REFER ALSO TO CITATION(S) 21020037249, 37543, 37544, 37545, 37546, 37548, 37549, 37555, 37556, 37558, 37559, 37560, 37608, 37609, 37615, 37616, 37640, 37644, 37645, 37666, 37668, 37669, 37670, 37671, 37672, 37673, 37674, 37675, 37684, 37685, 37686, 37687, 37688, 37690, 37691, 37692, 37694, 37698, 37699, 37700, 37701, 37704, 37708, 37709, 37713, 37715, 37723, 37724, 37725, 37727, 37940, 38589, 38590

37563 **(CONF-840614—87) Influence of fuel vibration on PWR neutron noise associated with core barrel motion.** Sweeney, F.J.; March-Leuba, J. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014253.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

Ex-core neutron detector noise has been utilized to monitor core support barrel (CSB) vibrations. In order to observe long-term changes, noise signals at Sequoyah-1 were monitored continuously during the whole first fuel cycle and part of the second cycle. Results suggest that neutron noise measurements performed infrequently may not provide adequate surveillance of the CSB because it may be difficult to separate noise amplitude changes due solely to CSB motion from changes caused by fuel motion and burnup. (DLC)

37564 **(DOE/ET/34212—41) Urania-gadolinia: nuclear model development and critical experiment benchmark.** Newman, L.W.; Wittkopf, W.A.; Pettus, W.G.; Baldwin, M.N.; Hassan, H.A.; Uotinen, V.O.; Connell, J.D.; Campbell, P.S. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Apr 1984. Contract AC02-78ET34212. 141p. (BAW—1810). NTIS (US Sales Only), PC A07/MF A01; 1; GPO Dep. Order Number DE84014833.

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The Babcock & Wilcox Company, Duke Power Company, and the US Department of Energy are participating in an extended-burnup program for pressurized water reactors that will develop an advanced fuel assembly design. This advanced fuel assembly uses a UO_2-Gd_2O_3 burnable absorber fuel mixture along with other state-of-the-art fuel performance and uranium utilization-enhancing design features including annual fuel pellets, annealed guide tubes, Zircaloy intermediate grids, and removable upper end fittings. As part of this program, a nuclear model for calculating the behavior of UO_2-Gd_2O_3 was developed, and critical experiments were conducted to provide beginning-of-life data for benchmarking the model. This report describes the nuclear model, the critical experiments, and the comparison of data between the model and the experiments. The comparison confirmed the accuracy of the standard two-group, diffusion theory model for predicting global and discrete UO_2-Gd_2O_3 effects provided the cross sections used in the model were generated with sufficiently detailed and sophisticated methods.

37565 **(EGG-TMI—6588) TMI abnormal waste project plan.** Ayers, A.L. Jr. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1984. Contract AC07-76ID01570. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014715.

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This report discusses plans for the TMI Abnormal Waste Project, which is part of the EPICOR and Waste Research and Disposition Program and funded by the US Department of Energy. The sequence proposed for disposition of Three Mile Island (TMI) abnormal wastes includes: (a) packaging at TMI, (b) shipment to the Idaho National Engineering Laboratory (INEL), (c) storage at INEL for up to 30 years, (d) processing for disposal, and (e) final disposal. Some wastes may be disposable immediately and would be processed and disposed without storage. Potentially, 930 ft^3 of cartridge filters, Submerged Demineralizer System filters, sludges, ion-exchange resins, and miscellaneous plant equipment may be classified as abnormal waste. Some wastes may be deleted and others added as cleanup progresses at TMI. The first waste classified as abnormal is Makeup and Purification Demineralizer resin. This report outlines storage plans, procedures, project management, costs, and schedules for placement of those resins.

37566 **(EPRI-NP—3041) Amine borane compounds in crevice-cleaning solutions. Final report.** Hunt, R.M. (Callery Chemical Co., PA (USA)). Jun 1984. 35p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920494.

This exploratory project investigated the corrosivity of dissolved tubesheet sludge in solvents containing hydrazine or a boron hydrogen reducing compound and with or without CCI-80 corrosion inhibitor. Of the compounds tested, preliminary results indicate that at 60°C (140°F) steel coupons were protected from corrosion best by the hydrazine boranes: hydrazine(bis)borane, methylhydrazine borane, and methylhydrazine(bis)borane. The methylhydrazine boranes protected the coupons about as well as hydrazine when CCI-80 inhibitor was present. When the inhibitor was absent however, the hydrazine boranes prevented coupon corrosion significantly better than hydrazine and about equal to hydrazine plus CCI-80. Less magnetite dissolved with hydrazine boranes compared to hydrazine-containing solvents but this problem can be corrected by adding a buffer, such as ammonium formate, to the solution.

37567 **(EPRI-NP—3508) Laboratory evaluations of mechanical decontamination and descaling techniques.** Gardner, H.R.; Polentz, L.M.; Bateman, D.B. (Quadrex, Richland, WA (USA)). Jul 1984. 69p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920461.

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The objective of this work was to evaluate a number of non-chemical industrial techniques that have potential for use in decontamination of portions of the reactor coolant system at TMI-2. The basis for the evaluation was the performance of the technique in tubing/pipe with respect to: (1) removal of simulated loose fuel debris, (2) removal of a corrosion layer, (3) the condition of the cleaned surface, and (4) cleaning of 90° elbows. Testing of the techniques was accomplished by demonstrations conducted at vendor sites and by laboratory work at Quadrex. Corrosion layers were simulated by using 0.75 in. oxidized Inconel tubing and either painted or oxidized 3 in. type 304 stainless steel pipe. Loose fuel debris was simulated with a 50:50 mixture of one and five micron tungsten powder. The most useful techniques for removal of both loose debris and corrosion layers were a rotating brush-hone tipped with SiC and a rotating, expanding wire brush. Although high/ultrahigh-pressure water was demonstrated to remove both loose debris and a corrosion layer, the relative roughness of the surface produced may present a recontamination problem if the component is to be reused. Pigs with a variety of surface coverings very successfully removed loose debris but could not remove a corrosion layer in one pass.

37568 **(EPRI-NP—3509) Use of pressurized water to decontaminate TMI-2 leadscrew sections.** Gardner, H.R.; Polentz, L.M. (Quadrex, Richland, WA (USA)). Jun 1984. 85p. NTIS, PC A05/MF A01; 1 - EPRI; GPO Dep. Order Number DE84015209.

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To support the recovery operation at TMI-2, this work was performed to evaluate the capability of high/ultrahigh-pressure water to remove loose fuel debris and tightly bonded radioactive cesium from both smooth and threaded sections of leadscrew removed from the TMI-2 reactor. The loose debris flushing was conducted at eight locations on a rotating leadscrew section using a 5000 psi water jet, and stand-off distances of 6, 12, 24, and 48 inches. Cesium removal studies were conducted at seven locations on rotating and translating leadscrew sections using water jet pressures of 5000 to 35,000 psi, stand-off distances of 1, 2.25, and 6 inches, and traverse rates of 19 and 37 in./min. Decontamination factors for loose debris removal were 1.1 and 2.0 on the smooth and threaded leadscrew sections, respectively. The low decontamination factors reflected the relatively small amount of loose debris present on the leadscrew sections. Loss of debris presumably occurred during handling and packaging. For the cesium removal work, decontamination factors increased with increasing pressure and stand-off distance, and decreased with increasing traverse rate. The maximum decontamination factor of 144 was obtained at a pressure of 35,000 psi, stand-off distance of 6 in., and traverse rate of 37 in./min.

37569 **(EPRI-NP—3510) High-pressure water systems for flushing loose fuel debris from the reactor underhead area at TMI-2.** Gardner, H.R.; Polentz, L.M.; Bateman, D.B. (Quadrex, Richland, WA (USA)). Jun 1984. 82p. NTIS, PC A05/MF A01 - EPRI; GPO Dep. Order Number DE84015211.

The objective of this work was to develop a remotely operated high-pressure water system for use inside the TMI-2 reactor pressure vessel to flush highly radioactive loose fuel debris from the underhead and plenum cover areas prior to head-lift operations. The work included development of conceptual designs, proof-of-principle demonstration, system fabrication and performance checkout, finnal design, and delivery of components to TMI-2. Two unique flushing systems that could be inserted into the pressure vessel through a control rod drive mechanism nozzle were developed and demonstrated. Their operability and effectiveness was demonstrated on a mockup of part of the reactor vessel and service structure that was especially built for this purpose. One flushing system uses a unique three-section, segmented, cable-operated, remotely controlled, nozzle-directing mechanism that can be used sequentially for flushing portions of both the underhead and the plenum cover areas. This system has the capability for remotely positioning and feeding a high-pressure water hose to move a nozzle along the plenum cover between selected rows of control rod drive tubes at a distance of 25 ft from the operating platform. The second remotely controlled flushing system uses stainless steel tubing and a

swivel to orient a nozzle in a 90° position for underhead flushing and limited plenum cover flushing. Testing of a number of rotating and stationary nozzles resulted in the development of a very effective 16-jet nozzle. This work demonstrated that flushing of the entire underhead and plenum cover areas could be accomplished using only four of the 69 control rod drive mechanism openings.

37570 **(EPRI-NP—3545) Thermal mixing in the lower plenum and core of a PWR. Final report.** Weimer, J.A. (Babcock and Wilcox Co., Lynchburg, VA (USA). Utility Power Generation Div.). May 1984. 82p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920446.

Beginning of cycle six and end of cycle six tests were performed at the Oconee 1 Nuclear Unit to quantify the amount of thermal mixing of the coolant in the reactor vessel. Asymmetric cold leg coolant temperatures were induced while various reactor vessel temperatures were monitored. The test successfully quantified the amount of thermal mixing in the lower plenum, core, and upper plenum. The testing also identified an unexplained mixing phenomena in the lower plenum and gave additional insight into gamma heating effects. Beginning of cycle six test data were also used to benchmark the spatial kinetics code BWKIN.

37571 **(EPRI-NP—3557) COMMIX-1A analysis of fluid and thermal mixing in a model cold leg and downcomer of a PWR.** Chen, B.C.J.; Cha, B.K.; Sha, W.T. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 64p. NTIS, PC A04/MF A01 - EPRI; GPO Dep. Order Number DE84015099.

Fluid and thermal mixing in a model cold leg and downcomer of a PWR was analyzed using COMMIX-1A. The present analysis differs from previous analyses reported in EPRI NP-3321 in three major aspects. First, extremely fine meshes were used to minimize numerical diffusion in the analysis. Second, one-equation (k) turbulence model was used to better model the turbulent flow. Third, curved surfaces were modeled by several slanted planes to better represent the geometries. By using these improvements, CREARE 1/5-scale test No. 51 was reanalyzed. Significant improvements were achieved in the comparisons between the COMMIX-1A calculations and the experimental data.

37572 **(EPRI-NP—3558) Signal processing for underclad cracks. Final report.** Shankar, R.; Lane, S.S.; Paradiso, T.J. (Tetra Tech, Inc., Arlington, VA (USA)). Jul 1984. 77p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920443.

Ultrasonic digital data were collected from underclad cracks in sample reactor pressure vessel blocks. These blocks were weld cladded under different processes to simulate conditions in US Pressurized Water Reactors. These data were used to develop algorithms for automatic crack depth sizing. Each crack was represented by a flaw echo dynamic curve, which is a plot of the ultrasonic transducer position on the surface as a function of the signal response along direction of beam propagation. Crack depth sizing was performed by identifying in the dynamic curve the diffracted signals from the crack upper and lower tips. Signal processing routines were developed to quantify and validate the crack tip signals. Deconvolution was used in the visualization of the phase reversal that must exist between tip signals and in quantifying signal similarity. The complex spectrum was used in comparing the tip ensemble spectra. It was found that valid data for sizing always exhibited a predictable spectral shape. This report describes the experimental procedure, digital signal processing methods used and the algorithms developed for automatic crack depth sizing.

37573 **(EPRI-NP—3630) Dilute reagent decontamination for pressurized water reactors. Final report.** Clark, R.L.; Johnson, A.B. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 208p. NTIS, PC A10/MF A01; 1 - EPRI; GPO Dep. Order Number DE84015098.

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The program has involved the following elements: screening studies with candidate reagents using nonradioactive autoclaved Inconel 600 and stainless steel specimens, procurement and characterization of radioactive Inconel 600 steam generator tube sections from operating PWRs, testing of candidate reagents on radioactive Inconel 600 tubing specimens, identification of dilute chemical decontamination methodology for PWRs, and develop decontamination reagents compatible with boric acid and lithium hydroxide (PWR coolant additives). Reagent studies conducted in a once-through test facility (OTTF), in recirculating acutoclaves, and in a recirculating test facility (RTF). Primary side films on Inconel 600 PWR steam generator tubing responded to strong oxidizing agents and to strong reducing agents. The reagent studies identified both single-stage and two-stage decontamination treatments that can remove large fractions of the radioactivity from Inconel 600 PWR steam generator tube specimens. The highest decontamination factors were achieved with reagents that largely removed the radioactive films as particulates. Reagent formulations have been identified that offer promise for testing under scale-up conditions. Engineering aspects of a PWR decontamination were discussed with the staff of a 1000-MWe PWR.

37574 **(GEND—026) Addition of soluble and insoluble neutron absorbers to the reactor coolant system of TMI-2.** Hansen, R.F.; Silverman, J.; Queen, S.P.; Ryan, R.F.; Austin, W.E. (GPU Nuclear Corp., Middletown, PA (USA)). Jul 1984. Contract AC07-76ID01570. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014877.

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The physical and chemical properties of six elements were studied and combined with cost estimates to determine the feasibility of adding them to the TMI-2 reactor coolant to depress k/sub eff/ to less than or equal to 0.95. Both soluble and insoluble forms of the elements B, Cd, Gd, Li, Sm, and Eu were examined. Criticality calculations were performed by Oak Ridge National Laboratory to determine the absorber concentration required to meet the 0.95 k/sub eff/ criterion. The conclusion reached is that all elements with the exception of boron have overriding disadvantages which preclude their use in this reactor. Solubility experiments in the reactor coolant show that boron solubility is the same as that of boron in pure aqueous solutions of sodium hydroxide and boric acid; consequently, solubility is not a limiting factor in reaching the k/sub eff/ criterion. Examination of the effect of pH on sodium requirements and costs for processing to remove radionuclides revealed a sharp dependence; small decreases in pH lead to a large decrease in both sodium requirements and processing costs. Boron addition to meet any contemplated reactor safety requirements can be accomplished with existing equipment; however, this addition must be made with the reactor coolant system filled and pressurized to ensure uniform boron concentration.

37575 **(GEND-INF—013) TMI-2 purification demineralizer resin study.** Thompson, J.D.; Osterhoudt, T.R. (EG and G Idaho, Inc., Idaho Falls (USA); GPU Nuclear Corp., Middletown, PA (USA)). May 1984. Contract AC07-76ID01570. 30p. NTIS, PC E04/MF $4.75; 1; GPO Dep. Order Number DE84014736.

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Study of the Makeup and Purification System demineralizers at TMI-2 has established that fuel quantities in the vessels are low, precluding criticality, that the high radioactive cesium concentration on the demineralizer resins can be chemically removed, and that the demineralizer resins can probably be removed from the vessels by sluicing through existing plant piping. Radiation measurements from outside the demineralizers establishing that there is between 1.5 and 5.1 (probably 3.3) lb of fuel in the A vessel and less than that amount in the B vessel. Dose rates up to 2780 R per hour were measured on contact with the A demineralizer. Remote visual observation of the A demineralizer showed a crystalline crust overlaying amber-colored resins. The cesium activity in solid resin samples ranged from 220 to 16,900 μCi/g. Based on this information, researchers concluded that the resins cannot be removed through the normal pathway in their present condition. Studies do show that the resins will withstand chemical processing designed to rinse and elute cesium from the resins. The process developed should work on the TMI-2 resins.

37576 **(GEND-INF—031-Vol.2) TMI-2 in-core instrument damage - an update. Volume II.** Yancey, M.E.; Meininger, R.D.; Hecker, L.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1984. Contract AC07-76ID01570. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015257.

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Additional in situ tests were performed during July and August 1983 on the in-core instruments located in TMI Unit 2. These tests were intended to reduce the uncertainty associated with early test data and better define the extent of damage in the reactor vessel. The condition of the self-powered neutron detectors and the location of newly formed thermocouple junctions suggests the possibility that significant damage occurred in the central area of the lower reactor vessel. The extension cables associated with the in-core instruments appeared to be in generally good condition.

37577 (IWGFPT—17, pp 49-55) **French experience to reduce radiation field build-up and improve nuclear fuel performance.** Thomazet, J. (Fragema, 69 - Lyon (France)); Beslu, P.; Noe, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)); Stora, J.P. (Electricite de France, 75 - Paris). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Over these last years, considerable information has been obtained on primary coolant chemistry, activity build-up and nuclear fuel behavior. As of December 1982, twenty three 900 MWe type reactors were in operation in France and about 1.3 millions of rods had been loaded in power reactors among which six regions of 17x17 fuel assemblies had completed successfully their third cycle of irradiation with a lead assembly burn-up of 37,000 MWd/MtU. Visual examination shows that crud deposited on fuel clads is mostly thin or inexistent. This result is due to the appropriate B/Li coolant concentration control which is currently applied in French reactors since several years. Correlatively, radiation field build-up is minimized and excessive external corrosion has never been observed. Nevertheless for higher coolant temperature plants, where occurrence of nucleate boiling could increase crud deposition, and for load follow and high burn-up operation, an extensive programme is performed jointly by Commissariat a l'Energie Atomique (CEA), Electricite de France, FRAMATOME and FRAGEMA to reduce even more the radiation field. This programme, described in the paper, includes: loop tests; on site chemical and radiochemical surveys; radiation field measurements; on site fuel examination crud-scrapping, crud analysis and oxide thickness measurements; hot cells examination. Some key results are presented and discussed in this paper.

37578 (IWGFPT—17, pp 73-82) **Some aspects of influence of coolant water chemistry on reliability of WWER and RBMK type fuels.** Solyany, V.I.; Bibilashvili, Yu.K.; Sukhanov, G.I.; Pimenov, Yu.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

In WWER and RBMK reactors now in operation a good quality of primary coolant is achieved and the required corrosion resistance of structural materials and normal irradiation conditions are ensured. Data on commercial fuel operation and clad material (Zr 1% Nb alloy) condition are briefly generalized. Some results of reactor investigations of corrosion behaviour of commercial Zr 1% Nb alloy under the condition of WWER and RBMK coolant are discussed and compared. It is established that the chemical effect of coolant on fuel cladding does not in itself limit its serviceability at design burn-ups but due to the possible processes of crud formation, corrosion (total and local), fretting-corrosion and hydriding it can influence the fuel reliability. This influence is qualitatively assessed through a rise in the clad temperature, a reduction of material plasticity and clad thickness.

37579 (IWGFPT—17, pp 91-96) **Laboratory scale investigation scheme to prognosticate corrosion characteristics of nuclear power plant systems.** Szabo, I. (Magyar Villamos Muevek Troeszt, Budapest); Torok, G.; Vodicska, M.; Vajda, N.; Nagy, L.G. (Budapesti Mueszaki Egyetem (Hungary)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

To determine the corrosion properties of system components in primary and secondary circuits of nuclear power plants long-term investigations are needed and experimental loops are required containing all the construction materials of the real system with operation parameters matching that of the power station as close as possible. A different approach should be looked for when response time of some days or weeks can not be exceeded. Comparative investigations were carried out to evaluate a fast method to determine corrosion characteristics of multi-component systems using the model samples representing typical components of a nuclear power plant. In the usual way corrosion rates were determined in experimental runs of several weeks in primary coolant solutions at the nominal operational temperature of 90-100 deg. C in the presence and in the absence of oxygen. On the other hand electrode potentials were measured in the coolant, while variations in surface and "near surface" elemental composition of the model samples during corrosion as well as the corrosion rate was measured in diluted decontamination solution. Comparing the results it could be established, that the proposed method can not offer absolute values of the corrosion rate but it can be used to determine the relative corrosion resistance of the system components and to prognosticate possible corrosion-incompatibility, and this can be done within a couple of hours.

37580 (IWGFPT—17, pp 122-126) **Water regime and core state in WWER reactors.** Goncharov, V.V.; Dubrovin, K.P.; Povalishin, N.B.; Chernorotov, E.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Some features of the ammonia-potassium water regime used in the WWER-reactors are considered. This regime makes it possible to suppress water radiolysis and simultaneously obtain a high pH value of the coolant, which is necessary in operation with boron control of the reactor power. Absence of oxygen and significant deposits on the zirconium alloy claddings of the fuel elements affect favourably the corrosion condition of the core. The thickness of the corrosion film on the fuel cladding at the end of their lifetime is as low as 3μm and the hydrogen content remains at the initial level.

37581 (IWGFPT—17, pp 132-141) **High pressure reactor water loop for the experimental studies in the field of water chemistry and corrosion.** Kysela, J.; Masarik, V.; Zajic, V.; Rypar, V.; Fric, Z. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

At the Nuclear Research Institute in Rez, an experimental reactor pressurized-water loop was built up on basis of a plan of technical development of nuclear power stations with PWR's. This loop is intended for further research and control of conditions in reactor circuits exposed to radiation. The loop (RVS-3) comprises a closed pressurized-water circuit with forced circulation and has a test section located in the core of the VVR-S type reactor, and filtration and measuring circuits. The loop is so equipped that it is

possible to operate the loop with the following nominal parameters: working overpressure 15.7 MPa; working temperature 350 deg. C; working medium chemically treated water; flowrate 10,000 kg/hr. The paper summarizes some results of experimental work carried out in NRI during the recent period in the field of electromagnetic filter development, technology of boric acid control and remote electro-chemical methods of measurement of instantaneous corrosion rate of materials. The results of the electromagnetic filter efficiency testing and the development work on the boric acid control by the thermal regeneration of strong base anion resins are presented. The results of the preliminary tests of corrosion of fuel cladding material (zirconium alloy Zr-Nb) in an out-of-pile loop with parameters corresponding to PWR primary circuit is also included.

37582 (IWGFPT—17, pp 145-149) **Effect of high temperature filtration on out-core corrosion product activity.** Horvath, G.L. (Institute for Electrical Power Research (VEIKI), Budapest (Hungary)); Bogancs, J. (Paksi Atomeroemue Vallalat (Hungary)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Investigation of the effect of high temperature filtration on corrosion product transport and out-core corrosion product activity has been carried out for VVER-440 plants. In the physico-chemical model applied particulate and dissolved corrosion products were taken into account. We supposed 100% effectivity for the particulate filter. It was found that about 0,5% 160 t/h/ of the main flow would result in an approx.50% reduction of the out-core corrosion product activity. Investigation of the details of the physico-chemical model in Nuclear Power Plant Paks showed a particle deposition rate measured during power transients fairly agreeing with other measurements and data used in the calculations.

37583 (IWGFPT—17, pp 200-210) **Primary coolant circuit characterization related to starting of the WWER-440 unit.** Bogancs, J.; Marothy, L. (Paksi Atomeroemue Vallalat (Hungary)); Bakos, L.; Baranyai, R.; Elek, A.; Rausch, H.; Szabo, E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Mass spectrometry, neutron activation analysis and gamma-spectrometry, particle sizing and photography of the corrosion products were used to qualify the constructional materials and primary coolants. The investigations related to: characterization of the constructional materials of the primary circuit, circulation washing, heat-running, physical and energetic start-up. The aim of the measurements was to study the cleanness of the primary circuit from neat-fitting up to energetic start-up and to follow closely the variation in the amount and the removing of the mechanical contaminants and corrosion products depending on the technological parameters. It could be verified that the neat-fitting was performed at the desired standard as was already indicated by the analytical results obtained from the membrane filters during the circulated washing of the primary circuit. The deviation of the corrosion products of the constructional materials was investigated as a function of the parameters of heat-running which showed maximal at the time of temperature transients. A correlation was established between the dimensions of the floating particles and the iron content of the membrane filters.

37584 (KAERI/RR—373/82, pp 1-153) **Development of PSI and ISI technique.** Chung, M.K.; Park, D.Y.; Choi, S.P.; Kim, H.J.; Moon, Y.S.; Shon, G.H.; Kim, T.S. 1983. (In Korean). NTIS (US Sales Only), PC A24/MF A01. Order Number DE84780092.

In Development of tests and evaluation technology for nuclear power plant components.

This report describes the experimental results of the subjects selected from the PSI/ISI related problems which encountered by us in 1982. The main contents are 1) the characteristics of the typical ECT signals from the steam generator tubes of nuclear power plant and the results of ECT evaluation of Kori-1 steam generators, 2) the experimental result for the research for directional effects of ultrasonic transducers, 3) the basic experiment for the ultrasonic testing technique by immersion testing method, 4) how to write the scan plan of the mechanized ultrasonic testing for nuclear reactor. Attached appendix is a part of necessary materials for the scan plan of the mechanized ultrasonic testing for Kori-2 nuclear reactor.

37585 (NNC-P—1) **Proof of evidence by National Nuclear Corporation Limited for Sizewell 'B' public inquiry.** Franklin, N.L. (National Nuclear Corp. Ltd., Knutsford (UK)). Feb 1983. 94p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84701581.

The history, experience and capability of National Nuclear Corporation Limited (NNC) and the requirements for the Sizewell B PWR project are reviewed. A Joint Project Team comprising staff from NNC, Westinghouse, Bechtel and the CEGB has been formed to develop the design of the station and the safety case. It is concluded that Sizewell B will be economic in its own right and will equip NNC with expertise, experience and resources in PWR technology. The construction of Sizewell B will provide the experience on which future PWR projects can proceed with confidence.

37586 (NUREG—1063) **Steam generator operating experience update, 1982-1983.** Frank, L. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Jun 1984. 49p. NTIS, PC A03/MF A01 - GPO $4.25. Order Number TI84901445.

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This report is a continuation of earlier reports by the staff addressing pressurized water reactor steam generator operating experience. NUREG-0886, Steam Generator Tube Experience, published in February 1982 summarized experience in domestic and foreign plants through December 1981. This report summarizes steam generator operating experience in domestic plants for the years 1982 and 1983. Included are new problems encountered with secondary-side loose parts, sulfur-induced stress-assisted corrosion cracking, and flow-induced vibrational wear in the new preheater design steam generators. The status of Unresolved Safety Issues A3, A4, and A5 is also discussed.

37587 (NUREG—1072-App.A) **Technical specifications, Catawba Nuclear Station, Unit 1 (Docket No. 50-413). Appendix A to License No. NPF-24.** Anderson, F.D. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 526p. NTIS, PC A23/MF A01 - GPO* $10.00. Order Number TI84901669.

This appendix comprises the following: definitions, safety limits and limiting safety system settings, limiting conditions for operation and surveillance requirements, design features, and administrative controls. (DLC)

37588 **Welding and brazing of film probe sensor assemblies.** Moorhead, A.J. (Oak Ridge National Lab., TN). *Welding Journal (Miami);* 17-27(Oct 1983). Contract W-7405-ENG-26.

A joint program to study three-dimensional, two-phase (steam-water) fluid flow phenomena in the upper plenum and core of a pressurized-water nuclear reactor during the reflood state of a loss-of-coolant accident (LOCA) was undertaken by the US Nuclear Regulatory Commission in cooperation with its counterparts in West Germany and Japan. The overall objectives of the program were to determine: (1) whether steam that is formed inside a reactor core during a postulated LOCA can block the movement of emergency coolant into the core; (2) how the emergency coolant redistributes itself horizontally and vertically as it moves through the heated core; and (3) how the steam and water move and interact in the core downcomer and upper portion of the reactor while the coolant water fills the lower part of the reactor and starts to cool the core. The role of Oak Ridge National Laboratory (ORNL) under the Advanced Instrumentation for Reflood Studies (AIRS) Program was to develop and supply instrumentation systems for measurement of flow factors such as void fraction, fluid velocity and film thickness in large simulated segments of core assemblies

that use electrically heated rod simulators instead of radioactive fuel pins. The thermal cycle that the sensors will experience is a rise in temperature to about 700°C over a period of about 10 min, followed by a rapid decrease in temperature with a transient of up to about 300°C/s. The system pressure, at least in some tests, will be 0.7 MPa gage (100 psig). This cycle would occur in a reactor core after loss of coolant; the temperature rises and then sharply decreases when coolant is introduced from the emergency core cooling system.

37589 **Severity, causes and frequencies of pressure vessel thermal shock at U.S. pressurized water reactors (1963-1981).** Phung, D.L.; Cottrell, W.B. (Oak Ridge Associated Universities, Inc., TN). *Nuclear Engineering and Design;* **75**: No. 3, 375-388(Jun 1983). (CONF-830867—).

From 7. international seminar on computational aspects of the finite element method; Chicago, IL, USA (29 Aug 1983).

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This article summarizes the results of a study whose purpose was to identify and analyze events at U.S. pressurized water reactors (PWRs) which either resulted in or could be considered as precursors to pressure vessel thermal shock (PVTS). The data base includes approx.= 16,000 Licensee Event Reports on 49 PWRs, covering approx.= 329 reactor-Years from 1963 through 1981. The 99 identified events were assigned to one of five categories of severity. On this basis, 34 of the events were considered significant to PVTS. The events are categorized by cause and by vendor of the plant at which the event occurred. Some probabilistic risk assessment data are also developed.

37590 **Void fraction under high pressure, low flow conditions in rod bundle geometry.** Anklam, T.M.; Miller, R.F. (Oak Ridge National Lab., TN). *Nuclear Engineering and Design;* **75**: No. 1, 99-108(Apr 1983).

Void-fraction data are reported from a series of high pressure, low heat and mass flux experiments. Testing was performed in a heated vertical rod bundle with internal dimensions similar to a PWR fuel bundle. The results are of interest in analyses of small break loss of coolant accidents. The experiments showed that, at a given pressure, void-fraction data could be fitted to a drift-flux equation with a constant drift-velocity. The drift-velocity was observed to decrease with increasing pressure and was independent of void fraction: a characteristic normally associated with churn-turbulent flow. However, relevant drift-flux correlations found in the literature gave relatively poor predictions of void fractions. The best predictions were obtained from an empirical correlation based on dimensional analyses.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 21030037543, 37578, 37608, 37609, 37682

37591 (IWGFPT—17, pp 232-241) **Oxygen influence on water chemistry and steel corrosion in its injection in the low temperature part of the condensate/feed train of NPS with a RBMK-1000 reactor.** Sedov, V.M.; Khitrov, Yu.A.; Kritski, V.G.; Sofyin, M.V. (All-Union Scientific Research and Project Institute of Complex Power Technology, VNIPIEhT, Leningrad (USSR)); Eperin, A.P.; Varovin, I.A.; Volgin, G.D.; Petrov, A.A. (Leningrad V.I. Lenin Nuclear Power Station, State Committee for Utilization of Atomic Energy (USSR)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Injection of gaseous oxygen in condensate reduces steel corrosion. However, the information is lacking on possible influence of oxygen on the corrosion of steels with different chrome content and water iron concentration in the low-temperature part of the condensate/feedwater train of NPS with a RBMK-1000 reactor. A 1600 h.test experiment was carried out at the Leningrad NPS with water oxygen concentration of 200 mg/kg, and conductivity not higher than 0.2 ms/cm. All the steels tested demonstrated the 10-fold reduction of corrosion and release of corrosion products into water. The 2.5% chrome alloying of steel results in strong reduction (in respect to steel 20) of corrosion product release.

37592 (IWGFPT—17, pp 242-251) **Study of the state of the surface and the cladding material of the fuel elements in the channel-type boiling water reactor of the Leningrad nuclear power station.** Varovin, I.A.; Eperin, A.P.; Zakharzhevskij, Yu.O.; Nikiforov, S.A.; Tsykin, A.V.; Shevchenko, V.G. (Leningrad V.I. Lenin Nuclear Power Station, State Committee for Utilization of Atomic Energy (USSR)); Bibilashvili, Yu.K.; Solyanyj, V.I. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Dec 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The Leningrad Nuclear Power Plant with a total capacity of 4000 mln Kwt(el.) is the first station in the series of NPPs with Channel Type Boiling Light Water Cooled Graphite Moderated Reactors RBMK-1000. A wide complex of studies, including a study of the state of surfaces and cladding materials of fuel elements is carried out in the hot cells and materials testing boxes of LNPP. The studies of 300 spent fuel bundles have shown that the following processes have occurred on the outside surface of fuel elements; crud deposition; corrosion (local and total); hydrogeneration. A quantitative analysis of these processes has shown that they don't limit the efficiency of fuel elements.

37593 **Materials development for HTGR heat exchangers.** Johnson, W.R.; Roberts, D.I. (GA Technologies, Inc. San Diego, CA). *Journal of Engineering for Power;* **105**: No. 4, 726-734(Oct 1983).

High-temperature, gas-cooled reactors (HTGR's) are uranium/thorium-fueled, graphite-moderated, helium-cooled systems capable of producing high-temperature primary coolant. Several variants of this system are under active development in the United States and worldwide. In one version, the primary coolant heat is transferred to steam generators producing 538°C/16.5 MPa steam for use in electricity generation or process heat applications. The materials and design technology for steam generators in this system are well developed, relying heavily upon prior experience with fossil-fired steam generators and the steam generators of the commercial HTGR's. The major work that remains to be done is to complete qualification of the materials and to respond to evolving rules pertinent to elevatedtemperature nuclear design and construction. Other versions of the HTGR generate much higher primary coolant gas temperatures (850° to 950°C) and exchange this heat, through intermediate heat exchangers (IHX's), to a secondary loop for higher temperature process heat applications. Although IHX's for these systems are typically pressure-balanced (low-stress) units, their design involves several challenges, including the potential interactions between structural materials and impurities present in the HTGR primary coolant. Considerable work is required to qualify materials for IHX applications, including detailed mechanical property characterization, determination of environmental influences on performance, provision of welding materials and procedures for producing joints of adequate strength and integrity, and provisions for wear protection. Some of the work currently under way addressing these issues is described.

37594 **Adaptive collocation method for simultaneous heat and mass diffusion with phase change.** Chawla, T.C.; Leaf, G.; Minkowycz, W.J.; Pedersen, D.R.; Shouman, A.R. (Argonne National Laboratory, Argonne, IL). *American Society of Mechanical Engineers, [Paper];* **83-HT-21**: 9(Jul 1983).

The present study is carried out to determine melting rates of a lead slab of various thicknesses by contact with sodium coolant and to evaluate the extent of penetration and the mixing rates of molten lead into liquid sodium by molecular diffusion alone. The study shows that these two calculations cannot be performed simultaneously without the use of adaptive coordinates which cause con-

siderable stretching of the physical coordinates for mass diffusion. Because of the large difference in densities of these two liquid metals, the traditional constant density approximation for the calculation of mass diffusion cannot be used for studying their interdiffusion. The use of orthogonal collocation method along with adaptive coordinates produces extremely accurate results which are ascertained by comparing with the existing analytical solutions for concentration distribution for the case of constant density approximation and for melting rates for the case of infinite lead slab.

37595 **HTGR structural materials efforts in the USA.** Rittenhouse, P.L.; Roberts, D.I. (Oak Ridge National Lab., TN). pp 163-168 of Gas-cooled reactors today. Volume 4. Proceedings of the conference held in Bristol on 20-24 September 1982. London, England; British Nuclear Energy Society (1983). (CONF-820915—).

From BNES international conference on gas cooled reactors today; Bristol, UK (20 Sep 1982).

The status of ongoing structural materials programs being conducted in the U.S. to support development and deployment of the high-temperature gas-cooled reactor (HTGR) is described. While the total U.S. program includes work in support of all variants of this reactor system, emphasis is placed on work aimed at support of the steam cycle/cogeneration version of the HTGR. Work described includes activities to develop design and performance prediction data on metals, ceramics, and graphite.

37596 **HTGR structural materials efforts in the USA.** Rittenhouse, P.L. (Oak Ridge National Lab., TN (USA)); Roberts, D.I. (General Atomic Co., San Diego, CA (USA)). pp 163-168 of Gas-cooled reactors today. (Volume 4). Papers, discussion, closing address, corrigenda. Proceedings of the conference held in Bristol on 20-24 September 1982. London, England; BNES (1983). (CONF-820923—).

From Conference on gas-cooled reactors today; Bristol, UK (20 Sep 1982).

The status of ongoing structural materials programs being conducted in the U.S. to support development and deployment of the high-temperature gas-cooled reactor (HTGR) is described. While the total U.S. program includes work in support of all variants of this reactor system, the emphasis of this paper is on the work aimed at support of the steam cycle/cogeneration (SC/C) version of the HTGR. Work described includes activities to develop design and performance prediction data on metals, ceramics, and graphite.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 21040037683

37597 (IWGFPT—17, pp 127-131) **Composition of corrosion products in the coolant and moderator and their differential uptake and removal by ion exchange in pressurized heavy water reactors.** Lawrence, D.A.; Venkateswarlu, K.S. (Bhabha Atomic Research Centre, Bombay (India). Reactor Chemistry Section). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The removal of insoluble and soluble impurities present in the moderator and primary coolant circuit is accomplished by means of a purification unit consisting of a fine filter and an ion exchange demineralizer. Purification unit is put on service continuously both during reactor operation as well as in shut down condition to keep the impurities at minimum possible level all the time. The ion exchange resins used in demineralizers selectively pick up some radionuclides and therefore over a period of time the build up of the long lived nuclides pose problems in the handling and in the ultimate disposal of these IX columns. With a view to find out the radionuclides which get preferentially held up in such ion exchange resins, a systematic analysis was carried out which is presented in this paper.

37598 (IWGFPT—17, pp 159-173) **Influence of water pH and F^- ions contamination in Zirconium alloys corrosion behaviour.** Radulescu, M.; Pirvan, I. (Institutul de Reactori Nucleari Energetici, Pitesti (Romania)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The water chemistry of the primary circuit is one of the most important factors of influence on the corrosion behaviour in the PHWR of the fuel cladding materials: Zircaloy-2 and Zircaloy-4. We studied the influence of the water pH adjusted by LiOH. In this purpose were performed 3 days tests in lithiated water (pH: 10 - 13,5) at 360 deg. C and 180 bar on Zy-2 and Zy-4 samples. The gravimetric and micrographic results have shown that a LiOH concentration $<=1$g/l has only a small influence on the corrosion behaviour of Zy-2 and Zy-4, but the exceeding of this critical concentration leads to an accelerated corrosion of those alloys. In the same conditions (water temperature, pressure, pH) were tested Zy-2 and Zy-4 samples simulating crevice corrosion. The contacted samples had a similar corrosion behaviour as the above-mentioned samples at pH$<$12, afterwards the weight gain increased abruptly. The 90 days test at pH 11 conducted to a thick and inequal oxide, owing to the LiOH local concentration. Consequently, the utilisation of LiOH for in the primary circuit pH regulating, must be done carefully in order to avoid local concentration of LiOH. Refering to the noxious influence of the F^- ions as impurities in the primary circuit, we studied Zy-2 corrosion behaviour by 3 days tests in 1mg F^-/l and 10mg F^-/l solutions, at 300 deg. C, 350 deg. C and 400 deg. C.

37599 (IWGFPT—17, pp 185-190) **CANDU-600 heat transport sampling system.** Barber, D. (Atomic Energy of Canada Ltd., CANDU Operations, Mississauga, Ontario). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The chemistry specifications for the coolant in the heat transport system of CANDU-600 nuclear power plants take into account: (1) the actual materials of construction used in the main and auxiliary circuits, (2) the results of research and development work on the performance of CANDU primary loops, (3) the observed operating experiences at in-service plants. The sampling system provides facilities to collect, cool and depressurize coolant samples from four continuously flowing streams. Two samples come from two of the steam generator inlet lines and another two samples come from the main circuit pump discharges. The samples are subsequently analyzed for alkalinity, lithium, chloride, dissolved deuterium, conductivity and gamma activity. Increases in the concentration of radio-iodines identify the presence of new fuel sheath defects. The sampling system also provides facilities to monitor the concentrations of dissolved deuterium, oxygen and nitrogen in the coolant and to collect insoluble circulating species (crud) from coolant flows. Facilities are also provided to collect samples of cool pressurized coolant for laboratory analysis for dissolved gases. The CANDU-600 heat transport sampling system is a logical development from the systems already operating at the Pickering and Bruce Reactors.

37600 (IWGFPT—17, pp 191-199) **Activity build-up in pressure vessel type reactors.** Maroto, A.J.G.; Urrutia, G.A.; Fernandez-Prini, R.; Blesa, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Quimica de Reactores). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

A simplified model is presented which permits the calculation of the average activity on the fuel elements of a reactor which operates under continuous refuelling, based on the assumption of crud interchange between fuel element surface and coolant in the

form of particulate material only and using the crud specific activity as an empirical parameter determined experimentally. The net activity flux from core to out-of-core components is then calculated in the form of parametric curves depending upon crud specific activity and rate particulate release from fuel surface. The contribution to out-of-core radionuclide inventory arising in the release of activated material from core components is then assessed, and a way to estimate it numerically is presented. This method is based on experimentally determined cobalt-contents of structural materials and crud, and is specially suitable when high-cobalt alloys are present in-core. Activation of crud and release of activated materials are compared and it is shown that it is very likely that the latter may represent a sizable (and even the largest) fraction of the total cobalt activity. The use of the ratio of activities of 59 Fe to 54 Mn as a diagnostic tool for in-situ activation of structural materials is discussed.

37601 (IWGFPT—17, pp 210-219) **Direct radiochemical monitoring of the coolant samples for fission gases. A new method for detecting fuel cladding failure in pressurised heavy water reactors.** Lawrence, D.A.; Venkateswarlu, K.S. (Bhabha Atomic Research Centre, Bombay (India). Reactor Chemistry Section). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The presence of radioactivity in the primary heat transport system of PHWR to a large extent depends upon 'Fuel Performance'. Any damage to the integrity of fuel cladding will lead to the release of gaseous and particulate fission products into the surrounding coolant medium and therefore for the safe operation of PHWR it is very essential to keep track of fuel performance. Though radioiodines and delayed neutron count rates give clue towards the condition of fuel clad integrity, they are found to be ambiguous in giving an assessment of defects which may develop in the fuel cladding. Hence, an attempt has been made for the first time to directly measure the chemically inert rare gas fission products in the heavy water of the primary heat transport system (PHT) and is presented in this paper.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 21050037256, 37657, 37661, 37663, 37722

37602 (NIIAR—2(567)) **Studying the structure of the hydrogen-sodium two-phase flow.** Sroelov, V.S.; Bocharin, P.P.; Sajgin, A.A.; Vasilevich, T.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1983. 25p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701582.

Quantitative characteristics of the structure of the sodium-hydrogen two-phase flow formed in the reaction between water and sodium in a tube of counterflow steam generator, which are essential for calculation of the reaction solid product crystallization on the tube wall and determination of hydrogen release to the cover gas are investigated. An approximate model of the two-phase flow structure, including the exponential bubble size distribution parameter and coagulation constant which are determined experimentally, is proposed. Calculations according to the program developed, using this model approximate experimental results on hydrogen release to the cover gas during water supply into the tube 16 mm in diameter about 10 m long in the range of two-phase flow rates of 2-7.5 m/s and volume gas contents of 1-80% with accuracy of about 20%.

37603 (SU-DMS—81-R-5) **Modelling of in-reactor deformation behavior of fast breeder reactor core structral materials. Annual progress report for the period October 1, 1980 to April 30, 1981.** Miller, A.K. (Stanford Univ., CA (USA). Dept. of Materials Science and Engineering). Dec 1981. Contract AT03-80SF11486. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84010400.

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There has been a growing awareness of the need for physically based models to describe the in-reactor deformation of LMFBR core materials such as AISI 316. This report presents the preliminary approach for such a model based on the MATMOD constitutive equations developed at Stanford. Details of the approach are given which address the major physical and mechanical processes important in deformation during irradiation. These include: (1) The description of the total strain rate as a function of thermal and irradiation components, (2) irradiation hardening and softening due to dislocations, Frank loops, voids and precipitates, (3) the effects of precipitation on swelling and irradiation creep, (4) the effects of temperature, temperature history, stress and flux on swelling, and (5) description of steady state irradiation creep rate as a function of temperature, flux and stress. To help clarify the MATMOD equations, which form the basis of the approach, a short section summarizing the present equations is included. The central variables, breadth of the model and its underlying philosophy are presented.

37604 **Modeling considerations for the analysis of LMFBR steam generator tube clamps.** Lay, D.M.; Piper, R.M. (Stress Engineers, Babcock & Wilcox, Nuclear Equipment Division, Barberton, Ohio). *Journal of Engineering for Power;* **105**: No. 4, 771-774(Oct 1983).

In the design of the Babcock & Wilcox Helical Coil Liquid Metal Fast Breeder Reactor (LMFBR) Steam Generator, the tube bundle is connected to the feedwater and steam plenums via "inlet/outlet tubes." Of prime importance in the design of these tubes is the tube-to-tube and tube-to-shell clamps which are provided to prevent detrimental vibration. This paper presents a method of modeling the tubeto-tube clamps to accurately predict tube-to-clamp interaction in the finite element analysis. It is also the objective of this paper to demonstrate the validity of specific modeling assumptions in determining stresses in the clamp assembly. As this paper deals only with the analytical approach taken, no detailed results are presented.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 21070037644, 37645, 37684, 37685, 37686, 37690, 37691, 37692

37605 (NRC—4901380) **US Nuclear Regulatory Commission 1983 annual report.** (Nuclear Regulatory Commission, Washington, DC (USA)). 18 Jun 1984. 200p. NTIS, PC A09/MF A01 - GPO. Order Number TI84901380.

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The thirteen chapters of this annual report are titled: 1983 highlights/1984 planning; reactor regulation; cleanup at TMI-2; operational experience; nuclear materials; safeguards; waste management; inspection, enforcement and emergency preparedness; cooperation with the states; international programs; nuclear regulatory research; proceedings and litigation; and management and communication. (DLC)

37606 (NUREG—0304-Vol.9-No.1) **Regulatory and technical reports. Compilation for first quarter 1984, January-March.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). May 1984. 141p. NTIS, PC A07/MF A01 - GPO*. Order Number DE84901444.

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This compilation consists of bibliographic data and abstracts for the formal regulatory and technical reports issued by the US Nuclear Regulatory Commission (NRC) Staff and its contractors. It is NRC's intention to publish this compilation quarterly and to cumulate it annually. This compilation covers January through March 1984.

37607 (NUREG—0540-Vol.6-No.4) **Title list of documents made publicly available.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Apr 1980. 637p. NTIS, PC A99/MF A01 - GPO*. Order Number DE84901513.

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The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes: (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials; and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

37608 **(NUREG—0748-Vol.4-No.5) Operating reactors licensing actions summary. Vol. 4, No. 5.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jul 1984. 394p. NTIS, PC A17/MF A01 - GPO*. Order Number DE84901550.

The operating reactors licensing actions summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. These reports utilize data collected from the Division of Licensing in the Office of Nuclear Reactor Regulation and are prepared by the Office of Resource Management. This summary report is published primarily for internal NRC use in managing the operating reactors licensing actions program. Its content will change based on NRC management informational requirements.

37609 **(NUREG—0748-Vol.4-No.6) Operating reactors licensing actions summary. Vol. 4, No. 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jul 1984. 399p. NTIS, PC A17/MF A01 - GPO*. Order Number DE84901784.

The operating reactors licensing actions summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. These reports utilize data collected from the Division of Licensing in the Office of Nuclear Reactor Regulation and are prepared by the Office of Resource Management. This summary report is published primarily for internal NRC use in managing the operating reactors licensing actions program. Its content will change based on NRC management informational requirements.

37610 **(NUREG—0750-Vol.19-No.1) Nuclear Regulatory Commission issuances, January 1984. Vol. 19, No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Jan 1984. 492p. NTIS, PC A21/MF A01 - GPO*. Order Number TI84901433.

This report includes the issuances received during January 1984 from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

37611 **(NUREG—0750-Vol.19-No.2) Nuclear Regulatory Commission issuances, February 1984. Vol. 19, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Feb 1984. 74p. NTIS, PC A04/MF A01 - GPO. Order Number DE84901476.

This report includes the issuances received during February 1984 from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM). The summaries and headnotes preceding the opinions reported are not to be deemed a part of those opinions or to have any independent legal significance.

37612 **(NUREG—0871-Vol.3-No.1) Summary information report. Volume 3, No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jun 1984. 51p. NTIS, PC A04/MF A01 - GPO. Order Number TI84901292.

The Summary Information Report provides summary data concerning NRC and its licensees for general use by the Chairman, other Commissioners and Commission staff offices, the Executive Director for Operations, and the Office Directors. It includes: organization overview, U.S. power reactors, standards, fuel facilities, agreement states, and export and foreign power reactor licenses.

37613 **(NUREG—0936-Vol.3-No.2) NRC Regulatory Agenda. Quarterly report, April-June 1984. Volume 3, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration). Jul 1984. 188p. NTIS, PC A09/MF A01 - GPO*. Order Number TI84901508.

The Regulatory Agenda is a quarterly compilation of all rules on which the NRC has proposed, or is considering action as well as those on which it has recently completed action, and all petitions for rulemaking which have been received and are pending disposition by the Commission.

37614 **(NUREG—0980) Nuclear Regulatory legislation.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the Executive Legal Director; Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel). Jun 1984. 652p. NTIS, PC A99/MF A01 - GPO* $11.00. Order Number TI84901420.

This compilation of statutes and material pertaining to nuclear regulatory legislation through the 97th Congress, 2nd Session, has been prepared by the Office of the Executive Legal Director, U.S. Nuclear Regulatory Commission, with the assistance of staff, for use as an internal resource document.

37615 **(NUREG—1052) Federal/State cooperation in the licensing of a nuclear power project. A joint licensing process between the US Nuclear Regulatory Commission and the Washington State Energy Facility Site Evaluation Council.** (Nuclear Regulatory Commission, Washington, DC (USA); Washington State Energy Facility Site Evaluation Council, Olympia (USA)). May 1984. 52p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number TI84901455.

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This report summarizes and documents a joint environmental review and licensing process established between the US Nuclear Regulatory Commission (NRC) and the Washington State Energy Facility Site Evaluation Council (EFSEC) in 1980-1983 for the Skagit/Hanford Nuclear Project (S/HNP). It documents the agreements made between the agencies to prepare a joint environmental impact statement responsive to the requirements of the National Environmental Policy Act of 1969 (NEPA) and the Washington State Environmental Policy Act. These agreements also established protocol to conduct joint public evidentiary hearings on matters of mutual jurisdiction, thereby reducing the duplication of effort and increasing the efficiency of the use of resources of federal and state governments and other entities involved in the process. This report may provide guidance and rationale to licensing bodies that may wish to adopt some of the procedures discussed in the report in the event that they become involved in the licensing of a nuclear power plant project. The history of the S/HNP and of the agreement processes are discussed. Discussions are provided on implementing the joint review process. A separate section is included which presents independent evaluations of the process by the applicant, NRC, and EFSEC.

37616 **(NUREG—1058) Technical specifications, Callaway Plant, Unit No. 1. Appendix A to license No. NPF-25 (Docket No. STN 50-483).** Anderson, F.D. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1984. 497p. NTIS, PC A21/MF A01 - GPO*. Order Number TI84901442.

Technical specifications are presented for the limiting conditions for operation and surveillance requirements for the reactor core, reactivity control systems, power distribution limits, instrumentation, reactor coolant system, emergency core cooling systems, containment systems, plant systems, electrical power systems, refueling operations, special test exceptions, radioactive effluents, radiological environmental monitoring; design features of the site, con-

tainment, core, coolant system, and fuel storage; and plant staff organization.

37617 **(NUREG—1075) Decentralization of operating reactor licensing reviews: NRR Pilot Program.** Hannon, J.N. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 25p. NTIS, PC A02/MF A01 - GPO* $3.25. Order Number TI84901673.

This report, which has incorporated comments received from the Commission and ACRS, describes the program for decentralization of selected operating reactor licensing technical review activities. The 2-year pilot program will be reviewed to verify that safety is enhanced as anticipated by the incorporation of prescribed management techniques and application of resources. If the program fails to operate as designed, it will be terminated.

37618 **(NUREG/BR—0025-Vol.10-No.4) Information report on state legislation. Vol. 10, No. 4.** McQuade, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). 15 Jun 1984. 8p. NTIS, PC A02/MF A01 - GPO*. Order Number TI84901553.

Information on state legislation regarding the nuclear industry is presented.

2108 Economics

37619 **(DOE/BP—256) Environmental costs and benefits case study: nuclear power plant. Quantification and economic valuation of selected environmental impacts/effects. Final report.** (Nero and Associates, Inc., Portland, OR (USA)). Feb 1984. Contract AC79-83BP11552. 232p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84013591.

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This case study is an application, to a nuclear power plant, of the methodology for quantifying environmental costs and benefits, contained in the regional energy plan, adopted in April, 1983, by the Northwest Power Planning Council, pursuant to Public Law 96-501.The study is based on plant number 2 of the Washington Public Power Supply System (WNP-2), currently nearing completion on the Hanford Nuclear Reservation in eastern Washington State. This report describes and documents efforts to quantify and estimate monetary values for the following seven areas of environmental effects: radiation/health effects, socioeconomic/infrastructure effects, consumptive use of water, psychological/health effects (fear/stress), waste management, nuclear power plant accidents, and decommissioning costs. 103 references.

37620 **(DOE/NE—0054) Meeting our need for electric energy: the role of nuclear power.** (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015422.

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This report focuses on the projected long-term growth of electric demand and the resultant need for new electric generating capacity through the year 2010. It summarizes the results of several technical and economic analyses done over the past two years to present two alternative scenarios for the future growth of nuclear energy in the United States. The first of these scenarios is based on a reference assumption of continued economic recovery and growth, while the second assumes a more vigorous economic recovery. These alternative scenarios reflect both the role that electricity could play in assuring the future economic wellbeing of the United States and the role that nuclear power could play in meeting future electricity needs. The scenarios do not project an expected future; rather, they describe a future that can be achieved only if US industry is revitalized in several key areas and if current obstacles to construction and operation of nuclear power plants are removed. This report underscores the need for renewed domestic industrialization as well as the need for government and industry to take steps to allow nuclear energy to fulfill its original potential. Further, it suggests some specific actions that must be taken if these goals are to be met.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 22000037222

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 22010037720

37621 **(INIS-SU—236, pp 56-59) Problem of nuclear-reactor data acquisition, systematization, estimation and dissemination.** Golashvili, T.V. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The main scientific and methodological principles used as a basis for organizing an information system of nuclear-reactor data are discussed. A considerable economic effect obtained while designing nuclear reactors due to preliminary estimation of nuclear data is noted. The conclusion is made that it is necessary to create a specialized information centre of nuclear-reactor data on the basis of fast-response computer facilities.

37622 **(LA—10114-PR) Radiation transport. Progress report, October 1, 1982-March 31, 1983.** O'Dell, R.D. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015065.

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Research and development progress in radiation transport by the Los Alamos National Laboratory's Group X-6 for the first half of FY 83 is reported. Included are tasks in the areas of Fission Reactor Neutronics, Deterministic Transport Methods, and Monte Carlo Radiation Transport.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 22020037919

37623 **(BNL—34978) In-situ stress relief of expanded Alloy 600 steam generator tubing.** Woodward, J.; van Rooyen, D.; McIlree, A.R. (Brookhaven National Lab., Upton, NY (USA); Electric Power Research Inst., Palo Alto, CA (USA)). 1984. Contract AC02-76CH00016. 6p. (CONF-840664—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014560.

From 9. international congress on metallic corrosion; Toronto, Canada (3 Jun 1984).

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Stress corrosion cracking is the most common cause of defects in steam generator tubing. Methods of averting tubing damage are constantly under review. This paper concentrates on the problem of intergranular stress corrosion cracking, initiated on the primary side, in the expansion transition region of roller expanded Alloy 600 tubing. In general it is believed that residual stresses, arising from the expansion process, are the cause of the problem. The work reported here discusses the identification and implementation of an optimal, in-situ stress relief treatment.

37624 **(CONF-840614—84) Component aging illustrated in maintenance histories from IPRDS.** Kahl, W.K.; Borkowski, R.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014294.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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The centerpiece of the In-Plant Reliability Data (IPRD) program is a nuclear power plant component data base developed from

corrective maintenance records. The primary objective of this program is to establish a comprehensive source of information for reliability analyses, including the compilation of maintenance histories for failure statistics. The IPRD program is currently a pilot effort that has 36 reactor-years of data on pumps, valves, diesel generators, batteries, battery chargers and inverters from five nuclear plants. The data are collected under the auspices of the Institute of Electrical and Electronics Engineers (IEEE) to certify anonymity of the participating plants, and is funded by the Nuclear Regulatory Commission (NRC).

37625 (INIS-mf—8928, pp 321-332) **Metallurgical aspects of welding joint repairs in nuclear power engineering.** Hrivnak, I. (Vyskumny Ustav Zvaracsky, Bratislava (Czechoslovakia)). 1981. (In Slovak). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780241. (CONF-8112102—Vol.1).

From Conference on scientific research and production introduction studies of light water reactor power plants; Karlovy Vary, Czechoslovakia (1 Dec 1981).

In case of a defect in the material of the pressure vessel, of the primary circuit, the steam generator, etc., three aspects are always discussed: detection of the defects their interpretation and repair. The most frequent defects are: discontinuity of the type of inclusions in the basic material or in weld metals; defects such as cracks or discontinuities in austenitic weld deposits; and defects in structural steel or under the weld deposit. The first and second types of defects may be repaired by grinding and patch welding. For the third type a special method has been developed, namely the method of the 1/3 weld bead which during welding with an austenitic or ferritic electrode onto the structural steel will allow the repair of defects after grinding to maximum width and depth of 30 mm. Several layers are gradually welded onto one another. (M.D.).

37626 (IS—4845) **Design considerations for steel containments.** Fils, G.A.; Greimann, L. (Ames Lab., IA (USA)). Sep 1983. Contract W-7405-ENG-82. 179p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84014873.

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Steel containments provide a low-leakage housing for nuclear reactors. In the unlikely event of a break in the reactor primary system piping, the containment vessel is to prevent the spread of radioactivity. Steel containment vessels are essentially axisymmetric shells of revolution. Because of this, analysis models must be able to characterize three-dimensional behavior. Typically, the containment shell is represented by a discretized model composed of one-dimensional axisymmetric ring elements and solutions are found by numerical methods. The model is usually assumed to behave linear-elastically except in assessments of containment buckling capacity and localized dynamic loads. The main limitation of the axisymmetric model is that all structural characteristics of the actual containment are modeled as rotationally symmetric about a vertical axis at the containment center. The ASME Boiler and Pressure Vessel Code provides a standard for the determination of what loads must be considered in the design process. In addition to normal operating loads, the containments are designed to resist the severe loads resulting from plant mishaps or severe natural phenomena such as earthquakes or both. These loads are often dynamic in nature and thus require solutions in the time or frequency domain. Working-stress design philosophy is currently used for containment design. Therefore, the stresses are based on service load conditions. These stresses must be less than or equal to some fraction of the nominal resistance, as specified by the ASME Code. An expansion of this approach, that introduces the probabilities of load events and containment resistance, is also presented.

37627 (IS-M—494) **Fragility curves for steel containments with internal pressure.** Fanous, F.; Greimann, L. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 15p. (CONF-8406124—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014820.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

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Containment structures for nuclear power plants have long been designed for static internal pressure. However, since the Three Mile Island accident there has been heightened interest in the behavior of containments under conditions beyond design, particularly the actual, in-place resistance of containments to static internal pressure. Probabilistic methods are being applied to both the loading and resistance quantities so public risk can be accurately assessed. In this paper, a reliability assessment of a steel containment strength under uniform internal pressure is summarized. Typically the containment vessel is a stiffened shell structure. Failure modes for this type of structure are identified as general, inter-ring and panel failure. Simplified methods to predict the resistance of the vessel under internal pressure are presented. The Advanced First Order Second Moment technique is used in conjunction with the simplified methods to construct the cumulative distribution of the containment resistance as a function of pressure. Uncertainty of the basic variables which affects the containment resistance are propagated through the analysis to evaluate the total uncertainty of the system. The resulting distribution considering all possible failure modes is given for a typical Mark III steel containment. Fragility curves for the containment at 95% and 5% certainty are also given.

37628 (IWGFPT—17, pp 35-49) **Mechanisms governing the physico-chemical processes of transfer in NPP circuits.** Brusakov, V.P.; Sedov, V.M.; Khitrov, Yu.A.; Rybalchenko, I.L. (All-Union Scientific Research and Project Institute of Complex Power Technology (VNIPIEhT), Leningrad (USSR)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The paper deals with the theoretical physico-chemical processes of corrosion products and their radionuclide transport in NPS circuits by thermoelectromotive and electromotive forces of microgalvanic couples. The laboratory and rig test results as well as the NPP operating experience data confirm the developed theoretical concept validity.

37629 (IWGFPT—17, pp 141-145) **Capability of Bulgarian electromagnetic filters to remove crud from water streams in nuclear power stations.** Dobrevsky, I.D.; Litovska, G.; Konova, G.; Kalpakchiev, Z. (Vissh Khimiko-Tekhnologicheski Inst., Burgas (Bulgaria)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The Bulgarian version of the electromagnetic filter (EMF) is characterized by the specific configuration of its magnetic field. The latter is distinguished by the minimum intensity in the front zone of filter's beads bed and the maximum intensity in the end (with respect to movement of filtered flow) zone of the filter. This concept of the configuration of the magnetic field is based on the fact that the cruds contained in the treated water have different magnetic susceptibilities. The configuration of the magnetic field chosen permits that the cruds with greater magnetic susceptibility be retained mainly in the initial zones of EMF's beads bed in the direction of stream, i.e. the zones with smaller intensity of the magnetic field. The cruds with smaller magnetic susceptibility will be retained chiefly in the subsequent (with greater field intensity) zone of the filtering beads bed. Thus, conditions are created to increase the degree of cruds removal from the treated water streams as well as the "sorption" capacity of the filtering beads bed. This has been confirmed experimentally. For instance, it has been found out that with respect to the above characteristics the Bulgarian EMF has certain advantages over the "conventional" EMF manufactured by Kraftwerk-Union.

37630 (IWGFPT—17, pp 173-180) **Experience of continuous isokinetic sampling on the Winfrith reactor.** Comley, G.C.W.; Ferrett, D.J. (UKAEA Atomic Energy Establishment, Winfrith). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Multiheaded continuous isokinetic samplers have been in use for many years on the Winfrith reactor for sampling coolant and feedwater circuits. The design and mode of operation of these samplers is discussed. The availability of such samplers has proved valuable in support of such operational investigations as identification of Co-59 sources. In addition, the samplers have enabled mass balances of iron inventory to be carried out and the particle size distribution, composition and activity of circulating insoluble material to be assessed.

37631 **(NUREG/CR—3744-Vol.1) Heavy-Section Steel Technology Program. Semiannual progress report, October 1983-March 1984. Vol. 1.** Pugh, C.E. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 199p. (ORNL/TM—9154/Vol.1). NTIS, PC A09/MF A01 - GPO; GPO Dep. Order Number DE84012948.

The studies relate to all areas of the technology of materials fabricated into thick-section primary-coolant containment systems of light-water-cooled nuclear power reactors. The focus is on the behavior and structural integrity of steel pressure vessels containing cracklike flaws. Starting with FY 1984, the program was reorganized from seven into ten tasks: (1) program management; (2) fracture methodology and analysis; (3) material characterization and properties; (4) environmentally assisted crack-growth studies; (5) crack-arrest technology; (6) irradiation effects studies; (7) cladding evaluations; (8) intermediate vessel tests and analysis; (9) thermal-shock technology; and (10) pressurized-thermal-shock (PTS) technology.

37632 **Non-destructive method for determining neutron exposure.** Gold, R.; McElroy, W.N. (to Dept. of Energy). US Patent Application 6-547,681. 1 Nov 1983. 17p. Contract AC06-76FF02170.

Portions are illegible in microfiche products.

A non-destructive method for determination of neutron exposure in an object, such as a reactor pressure vessel, is based on the observation of characteristic gamma-rays emitted by activation products in the object by using a unique continuous gamma-ray spectrometer. The spectrometer views the object through appropriate collimators to determine the absolute emission rate of these characteristic gamma-rays, thereby ascertaining the absolute activity of given activation products in the object. These data can then be used to deduce the spatial and angular dependence of neutron exposure at regions of interest within the object.

37633 **Free convection in a partially submerged fluid loop.** Britt, T.E.; Wood, D.C. (E.I. du Pont de Nemours & Co. Savannah River Laboratory Aiken, SC). *American Society of Mechanical Engineers, [Paper];* **83-HT-67**: 7(Jul 1983).

Several natural convection loop systems are studied in order to determine the operational characteristics for a multiple loop container which is used to cool special nuclear reactor assemblies. Both analytical and experimental studies were undertaken to examine flow in both circular and rectangular flow loops. It was found that when a circular loop is heated at the bottom and cooled at the top, recirculation cells form at all input power fluxes. At fluxes between 0.1 W/cm^2 and 0.7 W/cm^2 the cells caused flow oscillations and reversals. With the circular loop heated from the side, no recirculation cells were observed at the power fluxes up to 1.5 W/cm.^{2} Boiling did not occur in the circular loop. For a rectangular loop heated and cooled on its vertical sides, no recirculation cells or flow reversals were seen. At input power fluxes above 1.2 W/cm^2, periodic boiling in the heated side caused flow oscillations.

37634 **Overview of the use of prestressed concrete in U.S. nuclear power plants.** Ashar, H.; Naus, D.J. (Nuclear Regulatory Commission, Washington, DC). *Nuclear Engineering and Design;* **75**: No. 3, 425-437(Jun 1983). (CONF-830807—). Contract W-7405-ENG-26.

From International conference on coal science; Pittsburgh, PA, USA (15 Aug 1983).

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The extent of the use of prestressed concrete in nuclear power plants is outlined. Evolution of large size prestressing systems and corrosion inhibiting materials is described. A summary of major problems which have been encountered with prestressed concrete construction at nuclear power plant containments in the United States is presented; that is, dome delamination, cracking of anchorheads, settlement of bearing plates, etc. Guidelines for a tendon inservice inspection program are described as well as the effectiveness of these programs. The paper concludes with an assessment of the overall effectiveness of the prestressed concrete containments.

2203 Fuel Elements

37635 **(HEDL-SA—3002-FP) Microstructure of irradiated Inconel 706 fuel pin cladding.** Yang, W.J.S.; Makenas, B.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76FF02170. 19p. (CONF-840604—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014649.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

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A fuel pin from the HEDL-P-60 experiment with a cladding of solution-annealed Inconel 706 breached in an apparently brittle manner at a position 12.7 cm above the bottom of the fuel column with a crack of 5.72 cm in length after 5.0 atomic percent burnup in EBR-II. Temperatures (time-averaged midwall) and fast fluences for the fractured area range from 447°C and 5.5 x 10^{22} n/cm^2 to 526°C and 6.1 x 10^{22} n/cm^2 (E > 0.1 MeV). Specimens of the fractured fuel pin section were successfully prepared and examined in both a scanning electron microscope and a transmission electron microscope. The fracture surfaces of the breached section showed brittle intergranular fracture characteristics for both the axial and circumferential cracks. Formation of γ' in the matrix near the breach confirmed that the irradiation temperature at the breached area was below 500°C, in agreement with other estimates of the temperature for the area, 447 to 526°C. A hexagonal eta-phase, Ni_3 (Ti,Nb), precipitated at boundaries near the breach. A more extensive eta-phase coating at grain boundaries was found in a section irradiated at 650°C. The eta-phase plates at grain boundaries are expected to have a detrimental effect on alloy ductility. A plane of weakness in this region along the (111) slip planes will develop in Inconel 706 because the eta-plates have a (111) habit relationship with the matrix.

37636 (IWGFPT—17, pp 220-223) **Nondestructive measurements techniques for waterside corrosion film thickness on Zircaloy cladding.** Lang, P.M. (Department of Energy, Washington, DC (USA)); Balfour, M.G. (Westinghouse Electric Corp., Pittsburgh, PA (USA)); Corsetti, L.V. (Combustion Engineering, Inc., Windsor, CT (USA)); Papazoglou, T.P. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

Under typical reactor operating conditions, zircaloy cladding initially oxidizes to form an oxide film. The formation and growth of this film depend on cladding surface temperature, coolant chemistry conditions, irradiation effects, and cladding metallurgical conditions. During extended burnup service, cladding corrosion may accelerate. This concern led to the development and widespread use of an eddy current based, nondestructive technique for rapid measurement of the oxide thickness on the surface of irradiated fuel rod cladding. This paper presents a description of this measurement technology (both its principle and several hardware manifestations), a discussion of the problems encountered in making measurements and interpreting the results, methods of calibrating the instruments, estimates of their accuracy, typical results, and a listing of facilities at which non-proprietary measurements employing this technique are being made. The technology and equipment are now in place to determine oxide film thickness nondestructiveiy, both for the kind of controlled experiment needed to develop correlations and for

power reactor fuel, to ascertain whether corrosion accelerates at extended burnup.

37637 (IWGFPT—17, pp 223-232) **Corrosion of Zr-1% Nb alloy in distilled water containing Cl or F ions at 300 deg.** C. Kosinov, V.A.; Kuchin, O.P.; Novikov, O.K.; Osharina, L.V.; Fedenko, V.I. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The paper discusses the results of the study into the effect of chloride - or fluoride-ions in the concentrations of 0.5, 5.0 and 500 mg/1 on corrosion of Zr+1% Nb alloy at 300 deg. C. Corrosion tests were conducted in autoclaves. It is established that fluoride- or chloride-ion adversely affects the corrosion of the alloy. Oxide films developed on alloy at 300 deg. C in water containing 0.5 mg/1 fluoride- or chloride-ion do not have any protective properties. Chloride-ion concentration of distilled water increased to 5-500 mg/1 results in decreased weight gains, retardation of corrosion process that is likely to be due to deceleration of depolarizer ion discharge reaction. Fluoride-ion concentration of water increased to 5.0 mg/1 results in accelerated corrosion of zirconium alloy.

37638 **Thermoplastic analysis of a sphere-pac fuel pin.** Kennedy, T.C.; George, T.L.; Peddicord, K.L. (Oregon State Univ., Corvallis). *Nuclear Engineering and Design;* **75**: No. 1, 57-65(Apr 1983).

This analysis is concerned with the thermomechanical response of a sphere-pac fuel pin. The fuel is modeled as an elastic-plastic continuum governed by the Mohr-Coulomb yield criterion and associated flow rule under plane strain conditions. Yielding is found to initiate at the outer-edge of the fuel, and a plastic zone progresses inward. When the fuel has completely yielded, there exist three distinct plastic zones corresponding to stress states on different facets of the yield surface. Closed form expressions for the displacement and stresses in each of the plastic zones are presented. Numerical results illustrating the variation of displacement and stress with radial position are given.

37639 **A probablistic model of annular-dispersed flow in a reactor subchannel as seen by cylindrical geometry impedance probes.** Allgood, G.O.; Roberts, M.J. (Instrumentation and Controls Division Oak Ridge National Laboratory P.O. Box X Oak Ridge, Tennessee 37830). pp 1171-1184 of Modeling and Simulation. Vol. 14. Vogt, W.G.; Mickle, M.H. Research Triangle Park, NC; Instrument Society of America (1983). (CONF-830464—).

From 14. annual modeling and simulation conference; Pittsburgh, PA, USA (21 Apr 1983).

A probabilistic model of annular-dispersed flow in a reactor subchannel as seen by cylindrical geometry impedance probes is developed from a finite element model of these electrodes in an inhomogeneous, isotropic medium of water and steam. The model is based on a derived finite difference equation for the potential at the center of a cube in terms of the potentials of the adjacent cubes and their material properties (Ampere's circuital law, low-frequency case). The probabilistic model returns admittance (or capacitance) signals for two sets of probes based on specified film and two-phase void fractions. These signals will have temporal variations based on flow velocities, probe separation distance, and frequency content of signals. The model assumes one-dimensional flow.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 22050037601, 38468, 38469, 38589, 38589, 38590

37640 (EPRI-CS—3343, pp 24/1-24/23) **Development and future trends of the mussel control program at Pilgrim Nuclear Power Station, Plymouth, MA.** Scotton, L.N.; Armstrong, W.J.; Garey, J.F.; McDonald, D.J. (Boston Edison Co., Braintree, MA). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Pilgrim Nuclear Power Station experiences mussel fouling. A continuous chlorination program in the salt water service water system and a circulating water heated water backwash program have greatly reduced the problem. Refinements to both programs are continuing, with expectations of continued improvements. 1982 savings from the mollusc control program were on the order of $2.4 million. Much credit for the success of the program is given to the existence of a defined personnel section which deals with the fouling problems of the station.

37641 (EPRI-CS—3343, pp 25/1-25/15) **Thermal backwash as a method of macrofouling control at Millstone Nuclear Power Station, Waterford, Connecticut, USA.** Johnson, G.; Foertch, J.; Keser, M.; Johnson, B. (Northeast Utilities Environmental Lab., Waterford, CT). Dec 1983. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE84920275. (CONF-8306181—).

From Symposium on condenser macrofouling control technologies; Hyannis, MA, USA (1 Jun 1983).

Fouling at the Millstone plants is predominantly due to Mytilus edulis, the blue mussel. Optimization studies of the problem have resulted in a seasonally-varied backwash program that has an annual savings of over $230,000. Continued optimization studies are planned.

37642 (INIS-mf—8961, pp 170-181) **Modern state of development of methods and means for decontamination of equipment of nuclear power plant with WWER-type reactors and tasks for their improvement.** Sedov, V.M.; Morozov, V.V.; Rakov, N.A.; Yulikov, E.I.; Balaban-Irmenin, Yu.V.; Voronezhev, L.N.; Listopadova, N.V. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Decontamination of equipment and buildings is now one of the main preconditios for ensuring normal exploataion of nuclear power plants. Necessity of the development new and of improving existing methods and means of decontamination is obvious. In this case it is necessary to follow such main criteria as efficiency of removal of radioactive depositions from contaminated surfaces; simplicity and reliability during exploitation; duration of the process; amount of radioactive wastes formed. Solution of this task is possible only when complex approach to the problem of decontamination is applied. For nuclear power plants with WWER-type reactors there is a row of effective methods and means of decontamination which have been successfully tested both in the USSR and in the other CMEA member-states. Experience has been accumulated on the decontamination of the primary coolant circuit as a whole but without the core and control-rod drives; main circulation pipelines; autonomous decontamination of the steam generators; decontamination of equipment and buildings. But these systems have to be developed further. Problems have remained not solved of autonomous decontamination of the reactor vessels and the top block of it, pipelines of the control-rod coolant system. Unification of all these systems of decontamination into a united complex with maximum utilisation of the regular equipment of the nuclear power plant will give a possibility to perform decontamination in a compressed period of time which in the end shall permit minimizing the

dead-time of a power reactor unit during the period of scheduled preventive maintenance.

37643 **(IPT—1225) Regional geology, tectonic, geomorphology and seismology studies of interest to nuclear power plants at Itaorna beach.** Hasui, Y.; Almeida, F.F.M. de; Mioto, J.A.; Melo, M.S. de. (Instituto de Pesquisas Tecnologicas, Sao Paulo (Brazil)). 1982. 159p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84702563.

It contains 4 folded maps.

The study prepared for the nuclear power plants to be located at Itaorna comprised the analysis and integration of Geologic, tectonic, geomorphologic and seismologic information and satisfactory results of regional stability were obtained.

37644 **(NUREG—1064) Draft environmental statement related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 336p. NTIS, PC A15/MF A01 - GPO* $8.00. Order Number DE84901636.

This Draft Environmental Statement contains the second assessment of the environmental impact associated with the operation of Millstone Nuclear Power Station, Unit 3, pursuant to the National Environmental Policy Act of 1969 (NEPA) and Title 10 of the Code of Federal Regulations, Part 51, as amended, of the Nuclear Regulatory Commission regulations. This statement examines the environment, environmental consequences and mitigating actions, and environmental and economic benefits and costs.

37645 **(NUREG/CR—3054) Closeout of IE Bulletin 81-03: flow blockage of cooling water to safety system components by Corbicula sp. (Asiatic clam) and Mytilus sp. (mussel).** Rains, J.H.; Foley, W.J.; Hennick, A. (Parameter, Inc., Elm Grove, WI (USA)). Jun 1984. 56p. NTIS, PC A04/MF A01 - GPO* $4.50. Order Number TI84901479.

On April 10, 1981, the Office of Inspection and Enforcement (IE) of the U.S. Nuclear Regulatory Commission (NRC) issued Bulletin 81-03 requiring all nuclear generating unit licensees to assess the potential for biofouling of safety-related system components as a result of Asiatic clams (Corbicula sp.) and marine mussels (Mytilus sp.). An assessment of the areal extent of Asiatic clam and marine mussel infestation has been made along with an evaluation of detection and control procedures currently in use by licensees. Recommendations are provided with regard to adequacy of detection, inspection and prevention practices currently in use, biocidal treatment programs, and additional areas of concern. Safety implications and licensee responsibilities are discussed. Of 79 facilities licensed to operate, 17 have reported biofouling problems, 21 are judged to have high biofouling potential, 17 are judged to have low or future potential, and 24 are judged to have little or no potential. For 49 facilities under construction, the number of units for matching conditions of biofouling are 3, 25, 15, and 6 in the same decreasing order of severity.

37646 **(RISO-R—434) Wind speed and direction changes due to terrain effects revealed by climatological data from two sites in Jutland.** Hedegaard, K.; Larsen, S.E. (Risoe National Lab., Roskilde (Denmark)). May 1983. 120p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84701524.

The report discusses the influence of inhomogeneous surface conditions on meteorological data from two neighbouring sites in Jutland. The difference in the averages of the wind speed at the two stations is attributed to dissimilarities in roughness in the area and is described by the use of similarity laws for the neutral planetary boundary layers and for the neutral surface boundary layer. In contrast, the difference in the averages of the wind direction is attributed to both momentum balance requirements with changing topographical height, and the differential heating and/or cooling within the area.

2206 Research, Test, And Experimental Reactors

37647 **(DOE/ER/01560—18) University of Wisconsin Nuclear Laboratory, Madison, Wisconsin. Annual report, 1983-1984.** Cashwell, R.J. (Wisconsin Univ., Madison (USA). Nuclear Reactor Lab.). 1984. Contract AC02-76ER01560. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014888.

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This report is divided into the following sections: summary of operations (instructional use, reactor sharing, activation, etc.), operating statistics and fuel exposure, emergency shutdowns and inadvertent scrams, maintenance, changes in facility or procedures, radioactive waste disposal, summary of radiation exposures, and environmental surveys. (DLC)

37648 **(DOE/ER/10229—19) University of Wisconsin Nuclear Reactor Laboratory annual report, fiscal year 1983-1984.** Cashwell, R.J. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1984. Contract FG02-81ER10229. 14p. NTIS, PC A02; 3; GPO Dep. Order Number DE84014926.

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Operational activities for the reactor are described concerning nuclear engineering classes from the University of Wisconsin; reactor sharing program; utility personnel training; sample irradiations and neutron activation analysis services; and changes in personnel, facility, and procedures. Results of surveillance tests are presented for operating statistics and fuel exposure; emergency shutdowns and inadvertent scrams; maintenance; radioactive waste disposal; radiation exposures; environmental surveys; and publications and presentations on work based on reactor use.

37649 **(FEI—1392) Selecting an experimental volume value in a fast high-flux research reactor.** Antonova, V.N.; Lantsov, M.N.; Orekhov, V.I.; Chujkov, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701583.

The problem of selecting the main parameters of research reactors intended for conducting investigations on high-power fast reactor design is studied. It is shown that an experimental volume (EV) in a fast high-flux reactor, being a generalized characteristics, effects essentially the reactor power level, core power density, type and density of fuel composition. Sensitivity indexes of these values in respect to EV value is much more than a unit and increases sharply with the EV growth. In a general case, this circumstance leads to the fact that for a given neutron flux there is a definite minimum value of reactor power level when it may be realized at zero EV. Beginning from this power value and below it, the decrease of the neutron flux level is the only mean to maintain the required EV. When the reactor power is limited the only method to achieve required values of neutron flux at given EV is to increase the core power density.

37650 **(HEDL-SA—3047-FP) FFTF operational experience.** Newland, D.J.; Krupar, J.J. (Hanford Engineering Development Lab., Richland, WA (USA)). 12 Jun 1984. Contract AC06-76FF02170. 22p. (CONF-840813—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014648.

From Design, construction and operation of nuclear power plants conference; Portland, OR, USA (5 Aug 1984).

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In April 1982, the FFTF began its first nominally 100 day irradiation cycle. Since that time the plant has operated very well with steadily increasing plant capacity factors during its first four cycles. One hundred fifty fuel assemblies (eighty of which are experiments) and over 32,000 individual fuel pins have been irradiated, some in excess of 100 MWd/Kg burnup. Specialized equipment and systems unique to sodium cooled reactor plants have performed well.

37651 Neutron multiplication measurements using moments of the neutron counting distribution. Robba, A.A.; Dowdy, E.J.; Atwater, H.F. (Los Alamos National Lab., NM). *Nuclear Instruments and Methods in Physics Research;* **215**: No. 3, 473-479(1 Oct 1983).

We demonstrate an improved technique for determining the multiplication of highly subcritical systems that uses the moments of the counting distribution from a neutron detector. In the investigation, the multiplications of each of 2, 3, and 4 kg parts of a plutonium sphere were measured and compared with values calculated using three-dimensional Monte Carlo techniques. The measured and calculated neutron multiplication agree within the statistical uncertainties of the measurements and calculations.

37652 LOFT fuel rod transient DNB probability density function studies. Atkinson, S.A.; Fisher, J.E. (EG & G Idaho, Inc. Engineering Analysis Division Idaho Falls, Idaho). *American Society of Mechanical Engineers,* [*Paper*]; **83-HT-103**: 8(Jul 1983).

Significantly improved calculated DNB safety margins were defined by the development and use of probability density functions (PDF) for transient MDNBR nuclear fuel rods in the Loss of Fluid Test (LOFT) reactor. Calculations for limiting transients and response surface methods were used thereby including transient interactions and trip uncertainties in the MDNBR PDF. Applicability and sensitivity studies determined that the PDF and resulting nominal MDNBR limits are stable, applicable over a wide range of potential input parameters, and applicable to most transients.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 22070037667

37653 (DPST—83-665) Restart of R reactor at SRP. McDonell, W.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 18 Jul 1983. Contract AC09-76SR00001. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014979.

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Restart of the Savannah River R-Reactor is an alternative to L-Reactor operation for increased production of defense nuclear material. R-Reactor was shut down in 1964 after 11-years operation and has been on standby for 19 years. This report presents a description of R-Reactor operation to serve as a basis for analysis of environmental impacts after restoration to meet current SRP performance standards. R-Reactor operation would differ from L-Reactor operation principally in discharge and recycle of effluent cooling water to Par Pond, rather than direct discharge to the Savannah River by way of Steel Creek. Significant differences in environmental effects could result. A costly renovation program would be required to restore R-Reactor to operability, and the reactor could not contribute to material production before about 1989.

37654 (DPST—84-338) Validation of the simulator neutronics model. Gregory, M.V. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 31 Jan 1984. Contract AC09-76SR00001. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014978.

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The neutronics model in the SRP reactor training simulator computes the variation with time of the neutron population in the reactor core. The power output of a reactor is directly proportional to the neutron population, thus in a very real sense the neutronics model determines the response of the simulator. The geometrical complexity of the reactor control system in SRP reactors requires the neutronics model to provide a detailed, 3D representation of the reactor core. Existing simulator technology does not allow such a detailed representation to run in real-time in a minicomputer environment, thus an entirely different approach to the problem was required. A prompt jump method has been developed in answer to this need.

37655 (DPST—84-526) Preliminary plans for DMA Phase III. Suich, J.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA)). 1983. Contract AC09-76SR00001. 8p. NTIS, PC A02; 3; GPO Dep. Order Number DE84014976.

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Information is presented concerning the DMA logic to be used for computerized training of reactor operators at the Savannah River Plant.

37656 Neutron filters for producing monoenergetic neutron beams. Harvey, J.A.; Hill, N.W. (Oak Ridge National Lab., TN (USA)); Harvey, J.R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs). pp 856-858 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

Neutron transmission measurements have been made on high-purity, highly-enriched samples of ^{58}Ni (99.9%), ^{60}Ni (99.7%), ^{64}Zn (97.9%) and ^{184}W (94.5%) to measure their neutron 'windows' and to assess their potential usefulness for producing monoenergetic beams of intermediate energies from a reactor. Transmission measurements on the Los Alamos Sc filter (44.26 cm Sc and 1.0 cm Ti) have been made to determine the characteristics of the transmitted neutron beam and to measure the total cross section of Sc at the 2.0 keV minimum. When corrected for the Ti and impurities, a value of 0.35 +- 0.03 b was obtained for this minimum.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 22090037802, 38151

37657 (AEEW-M—2059) Energy conservation in SIMMER. Arnold, L.A.; Knowles, J.B. (UKAEA Atomic Energy Establishment, Winfrith). Nov 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702571.

The SIMMER code contains models of the many interacting thermo-hydraulic processes that occur during a hypothetical core disruptive accident (HCDA), to provide an overall picture from accident initiation to containment loading. In calculations of roof loadings following the HCDA, errors in computing the overall energy balance were found to be up to ten times the kinetic energy of the sodium slug which creates the loading. On this account, the results were considered to be seriously compromised. This report describes a systematic investigation into the effect, nature and origin of the energy discrepancies. Its main conclusion are that, the errors stem from a systematic rather than a random source, energy errors for individual cells can be two decades larger than the mean value provided by the code, and cellular mass and energy errors are strongly correlated and they can actually increase when the mesh is refined. A likely cause of the conservation errors is identified as the solution of the liquid phase mass and energy equations at effectively different time instants during each timestep.

37658 (AERE-G—2952) Decontamination of fast reactor hulls and properties of immobilised waste forms. First annual progress report January-December 1983. Biddle, P.; Brown, P.E.; Rees, J.H. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Jan 1984. 3p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702568.

The objectives of this contract are threefold: (i) to characterise the activities associated with genuine hulls generated in reprocessing fuel from the Prototype Fast Reactor; (ii) to examine the feasibility of decontaminating the hulls by the use of simple low-temperature techniques; and (iii) to immobilise the hulls in cement and evaluate the products. Over the last year, work has concentrated in

areas (i) and (ii), but the balance of the programme is now shifting more towards topic (iii). Progress is reported.

37659 **(AERE-M—3366) Measurement of C-14 in nuclear installations.** Metcalfe, B.; Taylor, B.L. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Dec 1983. 15p. HMSO, London, price $4.00.

This paper surveys the current methods employed to monitor the level of C-14 arising at various nuclear installations. Headings are: arisings; analytical procedures (pretreatment of samples; trapping techniques; counting techniques). Relevant abstracts from papers published by workers in the field have been appended.

37660 **(BMI—1983-024) Evaluation of the Westinghouse Hanford standard problems A and B on the distribution of hydrogen.** Jahn, H.; Papadimitriou, P. (Bundesministerium des Innern, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Dec 1983. 175p. (In German). (GRS-A—810). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751841.

The HEDL-standard-problems A and B have been used to test numerical codes for the calculation of hydrogen distributions during degraded core accidents. The specification is limited on the lower part of the CSTF-container, which has been subdivided in two parts. In test A water and vapor is fed in horizontal direction into a preinertized container atmosphere, in contrast to test B, where helium and vapor is injected vertically in air. For ab-initio-calculations the lumped parameter codes RALOC Mod 1/80 and Mod 1/81 have been used as well as the finite difference codes TEMPEST and HMS. The RALOC-versions have been verified as system codes with good success in both experiments, with a significant improvement in the case of the more recent version. Among the finite difference methods the HMS code proofed its ability to predict the concentration distributions in the injection region. The temperature distribution, however, cannot be calculated satisfactorily with the HMS-code. In the case of the TEMPEST code, both distribution functions cannot be determined with sufficient accuracy. The present analysis of the standard problem calculations confirms the different application areas for the lumped parameter codes (system behaviour) and for the finite difference codes (special effects).

37661 **(BNL-NUREG—34824) TWIST: a transient two-dimensional intra-subassembly thermal hydraulics model for LMFBRs.** Khatib-Rahbar, M.; Cazzoli, E.G. (Brookhaven National Lab., Upton, NY (USA)). 03 Jun 1984. Contract AC02-76CH00016. 8p. (CONF-840408—16). NTIS, PC A02/MF A01; 1 - GPO; GPO Dep. Order Number DE84014383.

From 5. international conference on nuclear methods in environmental and energy research; Mayaguez, Puerto Rico (2 Apr 1984).

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Mathematical models and numerical methods for a two-dimensional porous body simulation of steady state and transient thermal-hydraulics conditions in LMFBR subassemblies resulting in the TWIST computer code are presented. Comparison of calculated results to steady state and transient out-of-pile sodium experiments show good agreement for cross-assembly temperature distributions for a wide range of heat transfer and flow conditions.

37662 **(BNL-NUREG—34942) Analysis of a typical BWR/4 MSIV closure ATWS using RAMONA-3B and TRAC-BD1 codes.** Hsu, C.J.; Neymotin, L.; Saha, P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 9p. (CONF-840813—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014691.

From Design, construction and operation of nuclear power plants conference; Portland, OR, USA (5 Aug 1984).

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Analysis of a typical BWR/4 Anticipated Transient Without Scram (ATWS) has been performed using two advanced, best-estimate computer codes, namely, RAMONA-3B and TRAC-BD1. The transient was initiated by an inadvertant closure of all Main Steam Isolation Valves (MSIVs) with subsequent failure to scram the reactor. However, all other safety features namely, the safety and relief valves, recirculation pump trip, high pressure coolant injection and the standby liquid (boron) control system were assumed to work as designed. No other operator action was assumed. It has been found that both RAMONA-3B (with three-dimensional neutron kinetics) and TRAC-BD1 (with point kinetics) yielded similar results for the global parameters such as reactor power, system pressure and the suppression pool temperature. Both calculations showed that the reactor can be brought to hot shutdown in approximately twenty to twenty-five minutes with borated water mass flow rate of 2.78 kg/s (43 gpm) with 23800 ppM of boron. The suppression pool water temperature (assuming no pool cooling) at this time could be in the range of 170 to 205°F. An additional TRAC-BD1 calculation with RAMONA-3B reactor power indicates that the thermal-hydraulic models in RAMONA-3B, although simpler than those in TRAC-BD1, can adequately represent the system behavior during the ATWS-type transient.

37663 **(CONF-840614—68) Sodium boiling dryout correlation for LMFBR fuel assemblies.** Carbajo, J.J.; Rose, S.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014257.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

Under certain postulated accident conditions for a Liquid Metal Fast Breeder Reactor (LMFBR), such as the failure of the shutdown heat removal system (SHRS), sodium boiling and clad dryout might occur in the fuel assemblies. It is important to predict the time from boiling inception to dryout, since sustained clad dryout will result in core damage. In this paper a dryout correlation is presented. This correlation is based on 21 boiling tests which resulted in dryout from the THORS BUNDLE 6A, a 19-pin full-length simulated LMFBR fuel assembly and from the THORS Bundle 9, a 61-pin full-length simulated LMFBR fuel assembly. All these tests were performed as follows: for each specified bundle power, an initial steady-state high sodium flow was established, for which sodium boiling did not occur in the bundle. The temperature at the outlet of the test section was ~ 700°C. Then, using a programmable pump control system, the flow was reduced to a low value and boiling occurred.

37664 **(CONF-840701—14) Fission product release from irradiated LWR fuel under accident conditions.** Strain, R.V.; Sanecki, J.E.; Osborne, M.F. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014766.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

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Fission product release from irradiated LWR fuel is being studied by heating fuel rod segments in flowing steam and an inert carrier gas to simulate accident conditions. Fuels with a range of irradiation histories are being subjected to several steam flow rates over a wide range of temperatures. Fission product release during each test is measured by gamma spectroscopy and by detailed examination of the collection apparatus after the test has been completed. These release results are complemented by a detailed post-test examination of samples of the fuel rod segment. Results of release measurements and fuel rod characterizations for tests at 1400 through 2000°C are presented in this paper.

37665 **(CONF-8406124—10) Failure/leakage predictions of concrete structures containing cracks.** Pan, Y.C.; Marchertas, A.H.; Kennedy, J.M. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014627.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

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An approach is presented for studying the cracking and radioactive release of a reactor containment during severe accidents and extreme environments. The cracking of concrete is modeled as the blunt crack. The initiation and propagation of a crack are deter-

mined by using the maximum strength and the J-integral criteria. Furthermore, the extent of cracking is related to the leakage calculation by using a model developed by Rizkalla, Lau and Simmonds. Numerical examples are given for a three-point bending problem and a hypothetical case of a concrete containment structure subjected to high internal pressure during an accident.

37666 **(CONF-8406124—11) Numerical studies of large penetrations and closures for containment vessels subjected to loadings beyond the design basis.** Kulak, R.F.; Hsieh, B.J.; Kennedy, J.M.; Ash, J.E.; McLennan, G.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014732.

From 2. workshop on containment integrity; Washington, DC, USA (13 Jun 1984).

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Numerical simulations of the macro-deformations of the sealing surfaces (gasketed junctures) of a PWR steel containment vessel's equipment hatch and a BWR Mk II containment vessel head have been performed. Results for the equipment hatch juncture indicate that the rotations of the hatch cover and penetration sleeve must be accounted for when performing leakage analysis because they can effect the compression of the gasket even though the gasket is in a pressure-seated configuration. Results from a leakage analysis indicated that excessive leakage can occur if the surface roughness is high and/or the compression set is high. Results for the Mk II head show that both the temperature and pressure loadings must be taken into account to obtain realistic responses. The temperature difference between the flanges and bolts has the important net effect of keeping the gasketed juncture closed, that is in metal-to-metal contact. Due to the high accident temperature, the gasket itself was found to achieve 100% compression set and thus could not perform its sealing function within the juncture.

37667 **(DPW—75-123) Nuclear safety control procedures for the Savannah River reactors.** (Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA). Atomic Energy Div.). 10 May 1976. Contract AC09-76SR00001. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013960.

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This document describes the control system and procedures currently in effect to ensure nuclear safety in the operation of the Savannah River reactors. It is intended to define administrative control agreements between the Savannah River Operations Office and the Contractor, E.I. du Pont de Nemours and Company, with respect to meeting the requirements of ERDA Manual Chapter 0540, Safety of ERDA-Owned Reactors. This document is in two parts: Part I contains a description of the basic system of control; it is approved jointly by the Savannah River Operations Office and Du Pont. Part I also serves as Category 5 of the Technical Specifications. Part II contains a more-detailed discussion and supplementary controls; changes in these details will be made by the Du Pont Atomic Energy Division when they appear to be necessary for improved operation of reactors or for clarification.

37668 **(EMI-E—14/77) Impact investigations of reinforced concrete plates. Pt. 3.** Langheim, H. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg im Breisgau (Germany, F.R.). Ernst-Mach-Inst.). Jun 1977. 67p. (In German). Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen (Germany, F.R.).

With 40 figs., 5 refs.

The influence of reinforcements on the local resistance of concrete slabs was investigated. Cylindrical solid-steel projectiles (material 9 S 20 K), caliber 4,5 cm, masses of 1,11 and 2,25 kg were fired into square concrete slabs (70 x 70 x 23 cm) having 4 different reinforcement at velocities from 150 to 430 m/s. Targets were 1 : 3,5 model slabs of a nuclear power plant protection wall with compressive strenghts from 333 to 412 kp/cm^2. The pictures of the damage on the rear side of the slabs under ultimate load show the influence of the reinforcement. Penetration depths and crater voluminae were measured as well as the spallation and scabbing crater diameters; also the maximum displacement of the reinforcement steels. The penetration depths found in our tests were compared with the results from the classical penetration formulae. Impact-time, impact-power and impact-pressure of projectiles out of the reactor internal were estimated.

37669 **(EPRI-NP—2955) Intermediate-scale combustion studies of hydrogen-air-steam mixtues. Final report.** Kumar, R.K.; Tamm, H.; Harrison, W.C. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jun 1984. 121p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920432.

Combustion of hydrogen-air-steam mixtures has been studied in a 2.3-m (8 ft.) diameter sphere and in a pipe-sphere combination consisting of a 0.3-m (1 ft.) diameter, 6-m (20 ft.) long pipe connected to the sphere. The range of concentrations investigated included 4 to 42% hydrogen and up to 40% steam by volume. Most of the experiments were conducted at 100°C and near-atmospheric pressure (~ 98 kPa) although some experiments were also performed at room temperature. The effects of fan-induced turbulence were investigated qualitatively. In some experiments, gratings in the form of perforated sheets were placed in the sphere to assess their effect on combustion. Combustible mixtures in the sphere, alone, were ignited either at the bottom, centre, or top with a single electric spark. To evaluate the effects of volume geometry on combustion, hydrogen-air mixtures were ignited either at the pipe end or at the sphere centre. The effects on combustion of concentration differences between the gases in the pipe and in the sphere were investigated by placing a rupture disc in the pipe near its junction with the sphere. Discussion of the experimental results is presented.

37670 **(EPRI-NP—3470) Documentation design for probabilistic risk assessment. Final report.** vonHermann, J.L.; Parkinson, W.J.; Land, R.E.; Leaver, D.E. (Wood-Leaver and Associates, Inc., San Jose, CA (USA)). Jun 1984. 225p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920437.

The manner in which a probabilistic risk assessment (PRA) of a nuclear plant should be documented is specified. These documentation specifications address both the format and content of a final PRA report. An explicit delineation of potential goals and objectives of PRA programs provided a framework by which the specific goals of the documentation process could be identified. An examination of these documentation goals, in turn, allowed the identification of those documentation features which will allow these goals to be efficiently achieved. The resultant specifications are presented in the form of an example skeleton PRA final report.

37671 **(EPRI-NP—3485) Studies of single- and two-phase heat transfer in a blocked four-rod bundle. Final report.** Drucker, M.; Dhir, V.K. (California Univ., Los Angeles (USA). Dept. of Mechanics and Structures). Jun 1984. 130p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920425.

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Correlations have been developed for the heat transfer coefficient in the vicinity of flow blockages in rod bundles. The heat transfer data have been obtained on a four rod bundle with sleeve-type blockages for a Reynolds number range of 230 to 6900 and void fractions up to 0.15. Significant enhancement of the heat transfer coefficient has been observed downstream of the blockage.

37672 **(EPRI-NP—3539) Best-estimate analysis of selected Chapter 15 SAR events to evaluate the impact of PCI failure criteria. Final report.** Jesick, J.F. (Combustion Engineering, Inc., Windsor, CT (USA)). Jun 1984. 37p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920427.

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This report summarizes the results of best estimate analyses of the Low and High Power CEA withdrawal events for San Onofre Units 2 and 3 and the Steam Line Break event for St. Lucie II. These events are of interest due to the large changes in local power density presented in the Safety Analysis Reports (SAR) and the potential for fuel failures induced by Pellet Clad Interaction (PCI). The best estimate analyses were performed to provide some

insight into the representativeness and sensitivity of the SAR analysis. The scope of effort included reviews of assumptions, input parameters and modeling used for the original evaluation. Where appropriate, modifications were made to produce best estimate values and the analysis was repeated. The results show significant reductions in both core and local power changes compared to the original licensing assessments; therefore, the possibility of some PCI impact on a best estimate basis is considered extremely unlikely.

37673 **(EPRI-NP—3553) Data on four PWR plant transients.** Healzer, J.M.; Bailey, P.G. (Levy (S.), Inc., Campbell, CA (USA)). Jul 1984. 74p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920440.

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This report presents transient operating plant data from four different PWR transients. Each of the transients are for a separate PWR, and each resulted in a plant shutdown due to a component malfunction or failure. The report includes a brief description of each PWR unit, the sequence of events during the transient, and all of the operating plant data found to be available from the transient.

37674 **(EPRI-NP—3562) Sensitivity studies of seismic risk models. Final report.** Ravindra, M.K.; Banon, H.; Sues, R.H.; Thrasher, R.D. (Structural Mechanics Associates, Inc., Newport Beach, CA (USA)). Jun 1984. 84p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920454.

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Recent PRA studies have used the Zion Method for estimating the seismic risks of nuclear power plants. During the course of these studies and in the subsequent regulatory and peer reviews, several questions were raised regarding the sensitivity of risk estimates. The present report has addressed these concerns with the objective of deriving generic conclusions. Sensitivity of seismically-induced severe core damage frequencies to different modeling assumptions was investigated using the Zion and Indian Point Unit 2 probabilistic safety studies as base cases. These included the effects of peak acceleration truncation, fragility modeling, dependence between component failures, and the significance of gross design and construction errors.

37675 **(EPRI-NP—3563) Thermal-hydraulic modeling of the primary coolant system of light water reactors during severely degraded core accidents.** Wassel, A.T.; Hoseyni, M.S.; Farr, J.L. Jr.; Ghiaasiaan, S.M. (Science Applications, Inc., Hermosa Beach, CA (USA)). Jul 1984. 162p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920442.

A computer code has been developed to predict the time history of the primary coolant system (PCS) thermalhydraulics during severely degraded core accidents. The developed PCS code is modular and simulates both pressurized and boiling water reactor primary systems. The developed model assumes a one dimensional flow of steam and hydrogen along the PCS. The heat transfer between the gas and structures is by either forced or natural convection and radiation. Heterogeneous condensation on cold surfaces, accounting for the effects of noncondensables, is included. The calculations commence with core uncovery. The predicted PCS thermalhydraulic information includes flow parameters, such as, system pressure, flow rate and gas temperature within each component, temperature of the structures within each component along the flow path, heat and mass transfer coefficients, water levels where appropriate and other thermalhydraulic information which is required for aerosol tracking calculations.

37676 **(EPRI-NP—3583) Systematic Human Action Reliability Procedure (SHARP).** Hannaman, G.W.; Spurgin, A.J. (NUS Corp., San Diego, CA (USA)). Jun 1984. 136p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920478.

This report presents the results of a project to develop a well-structured framework for systematically incorporating human-system interactions into probabilistic risk assessments (PRAs). The framework consists of seven distinct steps that represent the minimum number of activities that a PRA systems analyst and a human reliability analyst should perform together to produce a description of human interactions that enhances the usefulness and credibility of the study. SHARP provides a structure for: (1) identifying human interactions; (2) stating key assumptions; (3) focusing on key human interactions; (4) describing them in detail; (5) incorporating the influence of human actions on events modeled in PRA studies; (6) quantifying the impacts; and (7) documenting the results. To help the reader to understand the SHARP process, each SHARP step is illustrated by examples. In addition, the application of SHARP is demonstrated by the use of a comprehensive example based on a steam generator tube rupture accident. 57 references, 35 figures, 11 tables.

37677 **(EUR—8482) Characterization of the pressure wave originating in the explosion of an extended heavy gas cloud: critical analysis of the treatment of its propagation in air and interaction with obstacles.** Essers, J.A. (Commission of the European Communities, Luxembourg). 1983. 142p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84701576.

The protection of nuclear power plants against external explosions of heavy gas clouds is a relevant topic of nuclear safety studies. The ultimate goal of such studies is to provide realistic inputs for the prediction of structure loadings and transient response. To obtain those inputs, relatively complex computer codes have been constructed to describe the propagation in air of strong perturbations due to unconfined gas cloud explosions. A detailed critical analysis of those codes is presented. In particular, the relative errors on wave speed, induced flow velocity, as well as on reflected wave speed and overpressure, respectively due to the use of a simplified non-linear isentropic approximation and of linear acoustic models, are estimated as functions of the overpressure of the incident pulse. The ability of the various models to accurately predict the time and distance required for sharp pressure front formation is discussed. Simple computer codes using implicit finite-difference discretizations are proposed to compare the results obtained with the various models for spherical wave propagation. Those codes are also useful to study the reflection of the waves on an outer spherical flexible wall and to investigate the effect of the elasticity and damping coefficients of the wall on the characteristics of the reflected pressure pulse.

37678 **(EUR—8504) MULTIVOL an extension of the BIVOL blowdown code to a higher number of volumes.** Friz, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. 62p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701616.

The name of the code BIVOL indicates that essentially two (bis) control volumes are considered to determine the thermohydraulic behaviour of the loop. The code BIVOL gives appreciable results in simple cases and is very helpful in parameter studies. Being limited to two volumes, however, the code cannot describe the effect of cold water injection lines or other additional volumes in the loop. It was desirable to extend the capabilities of BIVOL to a higher number of control volumes, i.e. to go over from BIVOL to MULTIVOL. This reports presents the description of the MULTIVOL code (task of MAIN, modelling in MAIN, subroutine ALFA, subroutine QWALL), its application (nodalization, entrance data preparation), and the listing.

37679 **(EUR—8702) Shakedown and ratchetting below the creep range.** Ponter, A.R.S. (Commission of the European Communities, Luxembourg). 1983. 212p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84701577.

The report reviews current understanding of the behaviour of structure subject to variable mechanical and thermal loading below the creep range through a comparison of theoretical solutions and experimental studies. The particular characteristics of the austenitic stainless steels are emphasized in components subject to moderate primary loads and large thermal loads. The review shows that a clear classification of types of thermal loading is required in design. Two main classes, termed category A and B, exist which arise not from the magnitude of the thermal stresses but their extent through the material volume of the structure. In category A situations, the Bree plate problem being the prime example, the maxi-

mum thermal stresses occur over a volume of the structure which does not contain a mechanism of failure. As a result very large thermal stresses may be withstood without ratchetting occurring for sufficiently small mechanical loads. For category B situations, the maximum thermal stress occur within a volume of material which contains a mechanism of deformation. In such cases, the capacity of the structure to withstand thermal loading is limited by a variation of the maximum thermal stress at a material point of 2σsub(γ) where σsub(γ) is a suitably defined yield stress. This situation seems to be the most typical problem of the Liquid Metal Fast Reactor and the "3Sm" limit in the ASME III code restriction on secondary stress cannot be exceeded if ratchetting is to be prevented.

37680 **(HEDL-SA—3058-FP) DSTRESS-P: a new concept in fuel pin failure modeling.** Fox, G.L. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1984. Contract AC06-76FF02170. 22p. (CONF-840614—88). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014556.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

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A new technique is developed for analyzing fuel pin stresses and making failure predictions which requires much less computer time than present methods. The parametric approach makes it practical to perform multipin analysis during reactor transients.

37681 **(ITEF—151(1982)) Calculation of transients in reactor accidents. RAISA code.** Afanas'ev, A.M.; Lebedev, S.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701635.

The main algorithms for calculation of transients arising in accidents are given as realized in the "RAISA" code. A facility comprizing a reactor and a heat exchanger is considered. Stability of counting and monotony of different schemes of solution are analyzed. It is shown that representation of initial equations following an inexplicit scheme for the primary circuit and an explicit one for the secondary circuit is optimum from the viewpoind of the code fast response. The "RAISA" code is written in the "FORTRAN" language for BESM-6.

37682 (IWGFPT—17, pp 180-184) **Formation of corrosion deposits and their removal from heat transferring RBMK reactor surfaces.** Varovin, J.A.; Eperin, A.P. (Leningrad V.I. Lenin, Nuclear Power Station, State Committee for Utilization of Atomic Energy (USSR)); Konstantinov, Ye.A.; Sedov, V.M.; Senin, Ye.V.; Filippov, Ye.M. (All-Union Scientific Research and Project Institute of Complex Power Technology (VNIPIEhT), Leningrad (USSR)). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

The paper notes, that though the RBMK reactor equipment and pipe-lines are made of stainless steels and zirconium alloys, about 100 g/d of corrosion products enter the coolant from the surfaces of the recirculation circuits. Being activated in the neutron flux, corrosion products cover the inner surfaces of the circuit, leading to the increase of ionizing radiation levels near the equipment and to the degradation of heat removal conditions in the process channels. The amount of deposits on fuel elements in the region of near-wall nucleate boiling can exceed 100 g/m^2. The most efficient way of radioactive corrosion deposit removal is decontamination of the reactor recirculation circuit. Up to 1000 kg of corrosion products are removed by the decontamination of the RBMK-1000 reactor circuit inner surfaces with the help of oxalate-peroxide solutions. The resultant 5-7-fold decrease of gamma-background allows to reduce the personnel number for the reactor maintenance, which makes decontamination advisable from the economical point of view.

37683 (IWGFPT—17, pp 150-159) **Physical and chemical removal of radioactive oxide layers.** Blesa, M.A.; Baumgartner, E.C.; Maroto, A.J.G. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Quimica de Reactores). Dec 1983. NTIS (US Sales Only), PC A12/MF A01. Order Number DE84900841. (CONF-8306182—).

From IAEA meeting on influence of water chemistry on fuel element cladding behaviour in water cooled power reactors; Leningrad, USSR (6 Jun 1983).

When a nuclear reactor is operating under steady state conditions, the balance between release of activated crud and pick-up and activation of circulating crud dictates the overall contribution to the growth of radiation fields by the release of crud from the fuel elements. Whole-circuit decontamination procedures which are carried out with the fuel elements in-core must take into account that during such procedure this balance is abruptly changed in the sense of releasing considerable amounts of radioactivity towards out-of-core components. In principle, this disruption of balance operates against the decontamination objectives, usually the lowering of radiation fields throughout the primary circuit. This is applicable to the two processes that involve fuel decontamination: cycling redox techniques and whole-circuit chemical decontaminations. However, data on actual cycling redox procedures performed in Atucha I Nuclear Power Station are presented which demonstrate that under appropriate process conditions such release does not prevent the achieval of reasonable decontamination factors in critical components. The relevance of optimum cleaning rates, redeposition rates, reagent injection strategies, and the ways to achieve these are discussed. In chemical decontamination procedures, it is of importance to assess the relative contribution of fuel elements and out-of-core components to dissolved radioactive crud. In order to do this, the mechanisms of dissolution of crud on steel surfaces and on Zircaloy surfaces are compared for the most usual reagents.

37684 **(NUREG—0675-Suppl.23) Safety evaluation report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1984. 46p. NTIS, PC A03/MF A01 - GPO* $3.75. Order Number TI84901474.

Supplement 23 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plants, Units 1 and 2 (Docket Nos. 50-275 and 50-323) has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement addresses the applicant's requests for approval of 22 deviations from the requirements of Section III.G of Appendix R of Title 10 of the Code of Federal Regulations Part 50.

37685 **(NUREG—0675-Suppl.24) Safety evaluation report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323). Supplement No. 24.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 18p. NTIS, PC A02/MF A01 - GPO $3.00. Order Number TI84901675.

Supplement 24 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plant, Unit 1 and Unit 2 (Docket Nos. 50-275 and 50-323), has been prepared by the Office of Nuclear Reactor Regulation of the U.S. Nuclear Regulatory Commission. This supplement reports on the independent design verification program (IDVP) for Diablo Canyon Unit 1 that was performed between November 1981 and May 1984 in response to Commission Order CLI-81-30 and an NRC letter to the licensee of November 19, 1981 and its application by PG and E in the Internal Technical Program (ITP). Specifically, Supplement 25 presents the final resolution of the remaining issues and other matters identified in Supplements 18, 19 and 20. This SER Supplement applies only to Diablo Canyon Unit 1.

37686 **(NUREG—0675-Suppl.26) Safety evaluation report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323). Supplement No. 26.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 202p. NTIS, PC A10/MF A01 - GPO* $6.50. Order Number TI84901744.

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Supplement 26 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plants, Units 1 and 2 (Docket Nos. 50-275 and 50-323), has been prepared jointly by the Office of Nuclear Reactor Regulation and the Region V Office of the US Nuclear Regulatory Commission. The supplement reports on the status of the staff's investigation, inspection and evaluation of those allegations or concerns that have been identified to the NRC as of July 8, 1984. The report specifically addresses those allegations which the staff determined must be satisfactorily resolved prior to full power operation of Diablo Canyon Unit 1.

37687 **(NUREG—0680-Suppl.5) TMI-1 restart: an evaluation of the licensee's management integrity as it affects restart of Three Mile Island Nuclear Station (Unit 1 Docket 50-289). Supplement 5.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 168p. NTIS, PC A16/MF A01 - GPO $6.00. Order Number TI84901483.

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Supplement 5 to the Safety Evaluation Report (SER) on TMI-1 Restart documents the review by the Nuclear Regulatory Commission (NRC) staff of nine investigations conducted by the NRC Office of Investigations into matters identified as relevant and material to an evaluation of the licensee's management integrity. The staff has included, as part of its evaluation, materials from its review of the GPU v. B and W lawsuit record (NUREG-1020LD, GPU, v. B and W Lawsuit Review and Its Effect on TMI-1) as well as other relevant materials developed since the close of the record in the TMI-1 Restart proceeding. In developing its position on General Public Utilities Nuclear Corporation's character (i.e., management integrity), the staff evaluated matters that cast doubt on the licensee's character, individually and collectively; considered the remedial actions taken by the licensee; and balanced past improper conduct of the licensee against its subsequent record of remedial actions and performance and record of current senior management of the licensee. The staff concluded that, while the past improper conduct was grave, the remedial actions taken, the subsequent record of performance, and the record of current senior management support a finding that GPUN can and will operate TMI-1 without undue risk to the health and safety of the public.

37688 **(NUREG—0787-Suppl.6) Safety evaluation report related to the operation of Waterford Steam Electric Station, Unit No. 3 (Docket No. 50-382). Suppl.6.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1984. 168p. NTIS, PC A08/MF A01 - GPO $6.00. Order Number TI84901477.

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Supplement 6 to the Safety Evaluation Report for the application filed by Louisiana Power and Light Company for a license to operate the Waterford Steam Electric Station, Unit 3 (Docket No. 50-382), located in St. Charles Parish, Louisiana, has been prepared by the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission. The purpose of this supplement is to update the Safety Evaluation Report by providing the staff's evaluation of information submitted by the applicant since the Safety Evaluation Report and its five previous supplements were issued.

37689 **(NUREG—0828-Final) Integrated plant safety assessment. Systematic evaluation program, Big Rock Point Plant (Docket No. 50-155). Final report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). May 1984. 793p. NTIS, PC A99/MF A01 - GPO $14.00. Order Number DE84901343.

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The Systematic Evaluation Program was initiated in February 1977 by the U.S. Nuclear Regulatory Commission to review the designs of older operating nuclear reactor plants to reconfirm and document their safety. The review provides (1) an assessment of how these plants compare with current licensing safety requirements relating to selected issues, (2) a basis for deciding how these differences should be resolved in an integrated plant review, and (3) a documented evaluation of plant safety when the supplement to the Final Integrated Plant Safety Assessment Report has been issued. This report documents the review of the Big Rock Point Plant, which is one of ten plants reviewed under Phase II of this program. This report indicates how 137 topics selected for review under Phase I of the program were addressed. It also addresses a majority of the pending licensing actions for Big Rock Point, which include TMI Action Plan requirements and implementation criteria for resolved generic issues. Equipment and procedural changes have been identified as a result of the review.

37690 **(NUREG—0954-Suppl.2) Safety evaluation report related to the operation of Catawba Nuclear Station, Units 1 and 2 (Docket Nos. 50-413 and 50-414). Supplement 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1984. 134p. NTIS, PC A07/MF A01 - GPO $5.50. Order Number TI84901583.

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This report supplements the Safety Evaluation Report (NUREG-0954) and Supplement 1 with respect to the application filed by Duke Power Company, North Carolina Municipal Power Agency Number 1, North Carolina Membership Corporation, and Saluda River Electric Cooperative, Inc., as applicants and owners, for licenses to operate the Catawba Nuclear Station, Units 1 and 2 (Docket Nos., 50-413 and 50-414, respectively). The facility is located in York County, South Carolina, approximately 9.6 km (6 mi) north of Rock Hill and adjacent to Lake Wylie. This supplement provides more recent information regarding resolution or updating of some of the open and confirmatory issues and license conditions identified in the Safety Evaluation Report.

37691 **(NUREG—0954-Suppl.3) Safety evaluation report related to the operation of Catawba Nuclear Station, Units 1 and 2 (Docket Nos. 50-413 and 50-414).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1984. 138p. NTIS, PC A07/MF A01 - GPO* $5.50. Order Number TI84901646.

The report supplements the Safety Evaluation Report (NUREG-0954) issued in February 1983 by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission with respect to the application filed by Duke Power Company, North Carolina Municipal Power Agency Number 1, North Carolina Membership Corporation, and Saluda River Electric Cooperative, Inc. as applicants and owners, for licenses to operate the Catawba Nuclear Station, Units 1 and 2 (Docket Nos. 50-413 and 50-414, respectively). The facility is located in York County, South Carolina, approximately 9.6 km (6 mi) north of Rock Hill and adjacent to Lake Wylie. This supplement provides additional information supporting the license for fuel loading and precriticality testing for Unit 1.

37692 **(NUREG—1038-Suppl.1) Safety evaluation report related to the operation of Shearon Harris Nuclear Power Plant, Unit No. 1 (Docket No. STN 50-400). Supplement No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1984. 52p. NTIS, PC A04/MF A01 - GPO* $4.50. Order Number TI84901543.

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This report, Supplement No. 1 to the Safety Evaluation Report for the application filed by the Carolina Power and Light Company and North Carolina Eastern Municipal Power Agency (the applicant) for license to operate the Shearon Harris Nuclear Power Plant Unit 1 (Docket No. 50-400), has been prepared by the Office of Nuclear Reactor Regulation of the U.S. Nuclear Regulatory Commission. This supplement reports the status of certain items that had not been resolved at the time of publication of the Safety Evaluation Report.

37693 **(NUREG/BR—0051-Vol.6-No.1) Power Reactor Events. Volume 6, No. 1.** Massaro, S.A. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Jun 1984. 55p. NTIS, PC A04/MF A01 - GPO. Order Number TI84901598.

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Power Reactor Events is a bi-monthly newsletter that compiles operating experience information about commercial nuclear power plants. This includes summaries of noteworthy events and listings and/or abstracts of USNRC and other documents that discuss safety-related or possible generic issues. It is intended to feed back some of the lessons learned from operational experience of the various plant personnel.

37694 **(NUREG/CP—0048-Vol.3) Eleventh water reactor safety research information meeting. Volume 3. Containment systems research; status of source term reassessment; fuel systems research program; risk analysis.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1984. 713p. (CONF-8310143—Vol.3). NTIS, PC A99/MF A01 - GPO* $12.00. Order Number DE84900511.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Separate abstracts were prepared for papers presented in the following areas: (1) containment systems research; (2) status of source term research; (3) fuel systems research program; and (4) risk analysis.

37695 (NUREG/CP—0048-Vol.3, pp 7-12) **INEL BWR severe accident ATWS study.** Jouse, W.C. (EG and G Idaho, Inc., Idaho Falls). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3). Contract AC07-76ID01570.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The subject of this study is a postulated anticipated transient without scram (ATWS) at unit one of the Browns Ferry nuclear plant, a boiling water reactor (BWR). The development work is being conducted at the Idaho National Engineering Laboratory for the US Nuclear Regulatory Commission. It has long been recognized that the dominant ATWS transient in BWRs is the main steamline isolation valve closure pressurization type of event. This is because the steam supply system is isolalted from its condenser or thermal sink, and because the resultant pressurization causes a large power excursion, or because other ATWS transients ultimately degrade into this type. Resolution of this ongoing safety concern can only be effected through plant transient simulation. The analytic tool used in this study is RELAP5/MOD1.6. This version of RELAP5 has the capability to simulate BWR plants in that several special process models, such as a jet pump momentum mixer model, have been installed. The code has the capability to transport dissolved boron throughout the 1-D hydrodynamic solution using a strict donoring formulation, and to calculate the effect of this poison on the reactor power. Extensive checkout and verification of the Browns Ferry BWR model was performed. Some results are presented of the comparison of the model to plant transient data during a two pump trip test. Data comparison is quite favorable.

37696 (NUREG/CP—0048-Vol.3, pp 43-58) **Effect of small-capacity high-pressure injection systems on BWR transient initiated loss of injection accident sequences.** Ott, L.J. (Oak Ridge National Lab., TN). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3). Contract W-7405-ENG-26.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Severe Accident Sequence Analysis (SASA) Program at Oak Ridge National Laboratory (ORNL) performs detailed BWR accident analysis for dominant sequences previously identified by the application of probabilistic risk assessment (PRA) methodology. One of the dominant accident scenarios identified by almost every BWR PRA is the transient loss of vessel water injection sequence (designated as the TQUV sequence). In a TQUV sequence, there is a transient followed by reactor scram, followed by failure of all systems that would normally be relied upon to inject cooling water into the reactor vessel. If the reactor scram occurs from 100% power and no vessel makeup water is provided, the uncovering of active fuel begins after about 0.5 h, and is followed by destruction of the core if sufficient makeup water flow is not initiated. This paper, based on a recently completed SASA study, provides an analysis of the ability of the Control Rod Drive Hydraulic System (CRDHS) and the Standby Liquid Control (SLC) System to adequately cool the reactor core during TQUV accident sequences at Browns Ferry. These small-capacity, high-pressure injection systems have traditionally been ignored in BWR risk assessment.

37697 (NUREG/CP—0048-Vol.3, pp 69-79) **Analysis of BWR degraded core phenomena at Rensselaer Polytechnic Institute (RPI).** Podowski, M. (Rensselaer Polytechnic Inst., Troy, NY). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The purpose of this paper is to present the results of the research on the BAR severe accident analysis, performed in the Department of Nuclear Engineering at Rensselaer Polytechnic Institute. This work was sponsored by the Severe Accident Sequence Analysis (SASA) Program at Oak Ridge National Laboratory (ORNL) under the Containment Systems Research Branch of the Division of Accident Evaluation, Office of Nuclear Regulatory Research. The specific objectives of the work dealt with the development of new, improved models for the in-core phenomena leding to core degradation and meltdown. These new models should be used to enhance the applicability of the MARCH code for boiling water reactor (BWR) accident analysis. As a result of the work accomplished to date, a new BWR core model has been developed and implemented into a computer code called MELRPI. This code can be used as a subroutine to augment the existing BOIL subroutine in MARCH, or can be run as an independent computer program. Since the first version of MELRPI (MODO) was finished in 1982, both the component-models and the code itself have undergone several improvements. The second version (MELRPI MODI) was finished in the first half of 1983, while the most recent one (MELRPI MOD 2) was still being tested when this paper was written.

37698 (NUREG/CP—0048-Vol.3, pp 121-128) **Ex-vessel source term for fission products.** Powers, D.A.; Brockmann, J.E.; Bradley, D.R.; Tarbell, W.W. (Sandia National Labs., Albuquerque, NM; Ktech Corp., Albuquerque, NM). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3). Contract AC04-76DP00789.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The role fission product release and aerosol generation outside the primary system can have in determining the severe reactor accident source term is reviewed. Recent analytical and experimental studies of major causes of ex-vessel fission product release and aerosol generation are described. The ejection of molten core debris from a pressurized reactor vessel is shown to be a potentially large source of aerosols that has not been recognized in past severe accident evaluations. A mechanistic model of fission product release during core debris interactions with concrete is discussed. Calculations with this model are compared to correlations of experimental data and previous estimates of ex-vessel fission product release. Predictions with the mechanistic model agree quite well with the data correlations but do not agree at all well with estimates made in the past.

37699 (NUREG/CP—0048-Vol.3, pp 129-141) **Behavior of U_3O_8, Fe_2O_3, and concrete aerosols in a condensing steam environment.** Adams, R.E. (Oak Ridge National Lab., TN). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

A project is being conducted in the Nuclear Safety Pilot Plant (NSPP), located at the Oak Ridge National Laboratory

(ORNL), to study the behavior of aerosols similar to those assumed to be generated during LWR reactor accident sequences and released into containment. This project, which is part of the ORNL Aerosol Release and Transport Program, is sponsored by the Division of Accident Evaluation, NRC, and the purpose is to provide experimental qualification for light water reactor aerosol codes being developed at other laboratories.

37700 (NUREG/CP—0048-Vol.3, pp 172-187) **CONTAIN calculations of severe accident sequences at the Surry Nuclear Power Plant.** Tills, J.L.; Murata, K.K.; Williams, D.C. (Jack Tills Associates, Inc., Albuquerque, NM; Sandia National Labs., Albuquerque, NM). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3). Contract AC04-76DP00789.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The CONTAIN computer code has been used to analyze phenomena occurring in the Surry reactor containment during a postulated severe accident sequence. CONTAIN is an integrated containment thermohydraulic and aerosol transport code. It is capable of handling multiple cell representations of containment. The choice of the Surry plant provides an opportunity to compare the CONTAIN calculations to those recently performed by Battelle Columbus Laboratories. In the present work, CONTAIN was applied to two of the AB sequences treated by Battelle. A comparison of the results is summarized.

37701 (NUREG/CP—0048-Vol.3, pp 249-257) **Large scale simulation of debris bed coolability.** Theofanous, T.G.; Gherson, P.; Hu, K. (Purdue Univ., West Lafayette, IN). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The problem of coolability of top flooded volumetrically heated coarse particle (d > few millimeters) beds has received recent attention in connection with light water reactor severe accident assessments. Non-coolable beds on the containment floor imply basemat penetration and noncondensible gas generation, while coolability implies quenching of the initial corium melt energy and continuing steaming into the containment atmosphere. Clearly, both the mode of containment failure, as well as its likelihood and timing will vary depending on these two different phenomenological behaviors. The purpose of this paper is to present the description of and the initial data from an experimental facility. In addition to the size and shape effects, design criteria included provision for pressure variation, space-time power control, and instrumentation requirements.

37702 (NUREG/CP—0048-Vol.3, pp 258-324) **Overview of the HDR-containment tests.** Wolf, L.; Valencia, L.; Kanzleiter, T. (Kernforschungszentrum Karlsruhe, Germany; Battelle-Institut e.V., Frankfurt, Germany). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

In this paper, a review of the HDR containment experiments of Phase I of the HDR Safety Program is given together with a first comparison with a variety of pretest calculations by German, French and American codes. An outlook to the experiments planned during Phase II in 1984 and 1985 concludes this paper.

37703 (NUREG/CP—0048-Vol.3, pp 325-360) **Containment related tests at HDR - energy transfer to structures.** Almenas, K. Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The containment experiments conducted at the HDR facility represent an important contribution to a better understanding of the physical processes taking place within the containment after a LOCA. The experiments have greatly expanded the limited data base of measured energy and mass transfer rates within and between large, complex geometry volumes. The new data has: (A) In several domains bracketed the parameter range to be found in actual reactor containments. As a consequence, interpolation rather than extrapolation of experimental data can now be used in containment analysis. (B) Provided severe tests of some modeling aspects. The tests have shown that in the best estimate sense shortcomings exist in the modeling of: (1) energy transfer into structures; and (2) short term pressure gradients between containment zones. This presentation analyses the experiment to calculation agreement of energy transfer into structures.

37704 (NUREG/CP—0048-Vol.3, pp 361-399) **COBRA-NC: an advanced containment code.** Thurgood, M.J. (Battelle, Pacific Northwest Lab., Richland, WA). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The COBRA-NC computer code has been developed by the Pacific Northwest Laboratory for the US Nuclear Regulatory Commission. The code has been developed to analyze the response of light water reactor containment systems to transients that result in the release of steam, water, and noncondensable gases into the containment atmosphere. It is designed to predict room pressurization, pressure differentials between rooms, jet impingement forces, asymetric loads and hydrogen and noncondensable gas distributions within the containment. The COBRA-NC code provides a two-component, two-fluid, three-field representation of two-phase flow. It is a three-dimensional, compressible-flow, finite-difference code formulated in Cartesian coordinates. It may be run in any combination of lumped parameter, one-, two- or three-dimensions. It has been assessed against a large set of experimental containment data.

37705 (NUREG/CP—0048-Vol.3, pp 400-421) **Suppression pool dynamics research at MIT.** Sonin, A.A. (Massachusetts Inst. of Tech., Cambridge). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Recent research at MIT has addressed three areas: first, the scaling laws of safety relief valve-type steam discharges and the dynamic stability of such discharges in the limit of low pool subcooling and steam pass-through have been investigated. Second, the characterization of the condensation process in chugging, and, perhaps more importantly, the characterization of the general condensation process of steam onto turbulent, subcooled water have been considered. The aim is twofold: first, to establish the correlation between the condensation rate and the turbulence intensity in the water, and second, to investigate a new, intermittent condensation mode identified at high turbulence intensities. Finally, a simplified method of dealing with fluid-structure interactions in BWR pressure suppression pools has been developed and experimentally verified.

37706 (NUREG/CP—0048-Vol.3, pp 458-468) **Fission product chemistry in the primary system.** Elrick, R.M.; Sallach, R.A. (Sandia National Labs., Albuquerque, NM). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3). Contract AC04-76DP00789.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Significant retention of fission products in the primary system can occur during severe reactor accidents. Some of these retention processes have been identified, including their reaction rates and reaction products. The reactions investigated include: CsI, CsOH, and tellurium with the structural materials Inconel 600 and 304 stainless steel, tellurium with tin, silver and zircaloy, and boron carbide (B_4C) in steam and with CsOH and with CsI.

37707 (NUREG/CP—0048-Vol.3, pp 496-503) **PBF OBTRAN experiment results.** Ploger, S.A. (EG and G Idaho, Inc., Idaho Falls). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3). Contract AC07-76ID01570.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The most severe BWR anticipated transients with and without scram are predicted to be a generator load rejection with turbine bypass valve failure and a main steam line isolation valve closure ATWS, respectively. However, these operational events have not actually occurred during commercial reactor operation. Accordingly, during 1982 the Thermal Fuels Behavior Program of EG and G Idaho, Inc., was requested by the Nuclear Regulatory Commission to simulate these infrequent transients in the Idaho National Engineering Laboratory's Power Burst Facility (PBF) in order to assess the forms and extents of fuel rod damage. Four scrammed transients of increasing severity were performed during the OPTRAN 1-1 test, with four previously irradiated test rods (~ 1 m long) of 8x8 General Electric design mounted within the PBF test train. The OPTRAN 1-2 test consisted of a single, 20-s power excursion that simulated a main steam line isolation valve closure without scram. Two high-enriched, unirradiated coolant heater rods were plumbed in tandem, through variable orifices, with two irradiated GE test rods. This scheme produced the desired coolant conditions wherein boiling transitions and elevated cladding temperatures could occur. Results of tests are reported.

37708 (NUREG/CP—0048-Vol.3, pp 588-597) **Uniqueness in probabilistic assessments.** Bargmann, H.W. (Swiss Federal Inst. for Reactor Research, EIR, Wuerenlingen). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Evidence is brought forward that the current results of probabilistic assessments should be considered to be less than order-of-magnitude results; Both for the obvious reason of current lack of data as well as for the intrinsic reason that probabilistic problems can frequently not be well-posed. It is believed that from the general conclusion on the non-uniqueness in probabilistic assessments certain conjectures may be inferred concerning quantitative safety goals and the quantification of the human factor as well as the potential value of studies within the frame of surrogate plants.

37709 (NUREG/CP—0048-Vol.3, pp 598-609) **Perceptions of LWR risk for decision making.** Young, J.; Asselin, S. Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Industry Degraded Core (IDCOR) Program was designed to develop a comprehensive, technically sound position on the issues related to potential accidents in light water reactors. One of the goals is to acquire knowledge and data so that a more realistic approach to the problem is possible. Some of the IDCOR tasks develop information in a Probabilistic Risk Assessment (PRA) framework. The PRA approach is structured upon reliability characteristics for individual components, such as pumps, valves and relays, which can be used to predict the frequency of system failures. System failure combinations can then be used to predict the probability of undesirable plant response to given initiating events. The IDCOR PRA tasks provide a significant amount of information related to the response of the plant to severe accidents. This information has been derived in a logical and consistent manner and so provides a coherent and rational basis for decision-making.

37710 (NUREG/CP—0048-Vol.3, pp 610-622) **Some insights gained from conducting an EPRI-sponsored review of five PRA studies.** Joksimovich, V.; Frank, M.V.; Worledge, D.R. (NUS Corp., San Diego, CA; Electric Power Research Inst., Palo Alto, CA). Jan 1984. NTIS, PC A99/MF A01 - GPO* $12.00. Order Number TI84900511. (CONF-8310143—Vol.3).

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

A number of Probabilistic Risk Assessment (PRA) studies have been completed for specific plants at specific sites, and many more are in progress. These studies, motivated by a variety of objectives, range in scope from limited extrapolations of the Reactor Safety Study (RSS, 1975) methods or adaptations of RSS results (studies conducted under the NRC's Reactor Safety Study Methodology Applications Program - RSSMAP) to full-scale PRAs which retain the key elements of the RSS methodology, but have introduced new and improved techniques. As of mid-1983, twelve full scope (Level 3) PRA studies have been completed for LWRs located in the United States. These are presented together with information on operating license date, the plant basic design features, study sponsorship, report availability, initiation and completion dates.

37711 (NUREG/CR—2000-Vol.3-No.6) **Licensee Event Report (LER) compilation for month of June 1984. Volume 3, No. 6.** (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 84p. (ORNL/NSIC—200-Vol.3-No.6). NTIS, PC A05/MF A01 - GPO. Order Number TI84014886.

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This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period. The LERs are submitted to the NRC by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries.

37712 (NUREG/CR—2331-Vol.3-No.3) **Safety research programs sponsored by Office of Nuclear Regulatory Research. Quarterly progress report, July 1-September 30, 1983. Volume 3, No. 3.** Weiss, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC02-76CH00016. 152p. (BNL-NUREG—51454-Vol.3-No.3). NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. Order Number DE84011672.

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The projects reported are the following: HTGR Safety Evaluation, SSC Development, Validation and Application, CRBR Balance of Plant Modeling, Thermal-Hydraulic Reactor Safety Experiments, LWR Plant Analyzer Development, LWR Code Assessment and Application, Thermal Reactor Code Development (RAMONA-3B); Stress Corrosion Cracking of PWR Steam Generator Tubing, Bolting Failure Analysis, Probability Based Load Combinations for Design of Category I Structures, Mechanical Piping Benchmark Problems; Human Error Data for Nuclear Power Plant Safety-Related Events, and Human Factors in Nuclear Power Plant Safeguards.

37713 (NUREG/CR—3134) **SETS user's manual for vital area analysis.** Stack, D.W.; Hill, M.S. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1984. Contract AC04-76DP00789. 108p. (SAND—83-0074). NTIS, PC A06/MF A01 - GPO. Order Number TI84015027.

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This manual describes the use of the Set Equation Transformation System (SETS) for vital area analysis. Various techniques are presented for using SETS to solve vital area analysis fault trees. Depending on the input to SETS, the solution to the vital area analysis fault tree can be in terms of vital areas or primary events of the vital area analysis fault tree. The techniques presented are also suitable and efficient for other kinds of common cause analysis.

37714 (NUREG/CR—3470) **ATWS at Browns Ferry Unit One - accident sequence analysis.** Harrington, R.M.; Hodge, S.A. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 233p. (ORNL/TM—8902). NTIS, PC A11/MF A01 - GPO. Order Number TI84014964.

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This study describes the predicted response of Unit One at the Browns Ferry Nuclear Plant to a postulated complete failure to scram following a transient occurrence that has caused closure of all Main Steam Isolation Valves (MSIVs). This hypothetical event constitutes the most severe example of the type of accident classified as Anticipated Transient Without Scram (ATWS). Without the automatic control rod insertion provided by scram, the void coefficient of reactivity and the mechanisms by which voids are formed in the moderator/coolant play a dominant role in the progression of

the accident. Actions taken by the operator greatly influence the quantity of voids in the coolant and the effect is analyzed in this report. The progression of the accident sequence under existing and under recommended procedures is discussed. For the extremely unlikely cases in which equipment failure and wrongful operator actions might lead to severe core damage, the sequence of emergency action levels and the associated timing of events are presented.

37715 **(NUREG/CR—3849) Two-phase 3 x 3 rod bundle test facility for post-critical heat flux boiling.** Tuzla, K.; Unal, C.; Badr, O.A.; Neti, S.; Chen, J.C. (Lehigh Univ., Bethlehem, PA (USA). Inst. of Thermo-Fluid Engineering and Science). Jun 1984. 56p. NTIS, PC A04/MF A01 - GPO* $4.25. Order Number TI84901536.

This report describes the rod bundle post-CHF tests in progress and the test facility at Lehigh University. The mechanical and electrical design of the experimental facility and the iterative process used to arrive at the choices made for the design are described in detail. The test facility consists of a nine (3 x 3) rod bundle in a square shroud which form the test section together with the hot patches at the top and bottom ends. The rods and the hot patches are electrically heated while the shroud is radiatively heated. The test section includes instrumentation to measure the vapor superheat temperature and pressure drop upstream and downstream of a rod gap spacer. This is the first application of the hot patch technique for generating post-CHF conditions in a rod bundle and thus quasi-steady-state tests are being thought of as a backup procedure for conducting these post-CHF heat transfer tests. The test section is part of a well instrumented recirculating loop to generate the desired post-CHF conditions. The other major components of the heat transfer loop include the surge tank, pumps, boiler, separation tank and condenser.

37716 **(SAND—84-0359C) Large-scale molten core/material interaction experiments.** Chu, T.Y. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 8p. (CONF-840914—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014956.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

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The paper described the facility and melting technology for large-scale molten core/material interaction experiments being carried out at Sandia National Laboratories. The facility is largest of its kind anywhere. It is capable of producing core melts up to 500 kg at a temperature of 3000°K. Results of a recent experiment involving the release of 230 kg of core melt into a magnesia brick crucible is discussed in detail. Data on thermal and mechanical responses of magnesia brick, heat flux partitioning, melt penetration, gas and aerosol generation are presented.

37717 **(UCRL—52000-84-6) Energy and technology review.** (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014465.

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Separate abstracts have been prepared for the three reactor safety-related papers. (DLC)

37718 **(UCRL—90569) Reaction of water with solid and liquid uranium.** Balooch, M.; Olander, D.R.; Siekhaus, W.J. (California Univ., Berkeley (USA); Lawrence Livermore National Lab., CA (USA)). 25 Jun 1984. Contract W-7405-ENG-48. 17p. (CONF-840617—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014480.

From 12. DOE surface science/SUBWOG - 7. SUBWOG - 12B technical exchange meeting; Oak Ridge, TN, USA (11 Jun 1984).

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The reaction probability of water with solid and liquid uranium has been measured. The measurements are consistent with the data of Colmenares, extrapolated over 5 orders of magnitude in pressure (from 60 Torr to 10^{-4} Torr) and to higher temperatures using his activation energy and pressure dependence. The reaction probability is approximately 6×10^{-2} and constant above 800°K. There is certainly no dramatic change, maybe a small decrease, in the reaction probability as uranium melts. Two simple surface reaction models have been tried and found to be unsatisfactory.

37719 **(EPRI-NP—2709-CCM-Vol.1-Rev.2) ABAQUS-EPGEN: a general-purpose finite element code. Volume 1 (Revision 2). User's manual.** Hibbitt, H.D.; Karlsson, B.I.; Sorensen, E.P. (Hibbitt, Karlsson and Sorensen, Providence, RI (USA)). Jun 1984. 75p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920489.

This report discusses ABAQUS-EPGEN, a general-purpose finite element computer code designed specifically to serve advanced structural analysis needs. Volume 1 is the user's manual and addresses the issues of: (1) the program and its terminology; (2) analysis procedures; (3) the element library; (4) material modeling options; (5) input specifications for model data and history data; (6) user subroutines; (7) input specifications for the postprocessor; (8) the format for the computer-readable file; and (9) postprocessing options.

37720 **Time dependence of test fuel power coupling during Transient Reactor Test Facility irradiation experiments.** Klotzkin, G.; Harrison, L.J.; Hart, P.; Swanson, R.W. (Argonne National Laboratory, Argonne-West, TREAT Facility Idaho Falls, Idaho). *Nuclear Science and Engineering;* **86**: No. 2, 206-218(Feb 1984).

Studies have been conducted at the Transient Reactor Test Facility (TREAT) to determine the variation during transient irradiation experiments of the ratio of axial midplane test fuel power to reactor power as measured by ex-core ion chamber current. It is shown that the dependence of this ratio on core temperature is generally small. However, effects due to control rod motion can be substantial. A simple mathematical expression that predicts the dependence of this ratio on control rod position is shown to give good agreement with integral experimental data. This work makes possible refinements in obtaining the desired power-versus-time behavior in test fuel by accounting for the effects of instantaneous position of control rods and core temperature during transient operation.

37721 **SIMMER-II recriticality analyses for a homogeneous core of the 300-MW (electric) class.** Maschek, W.; Asprey, M.W. (Institut fur Neutronenphysik und Reaktortechnik Kernforschungszentrum Karlsruhe, Karlsruhe 1). *Nuclear Technology;* **63**: No. 2, 330-336(Nov 1983).

The behavior of a homogeneous reactor core of the 300-MW (electric) class has been evaluated during the pretransition and transition phases of a hypothetical loss-of-flow accident without scram. The SIMMER-II code has been used to track core material redistribution processes, which can lead to recriticalities and secondary nuclear power excursions. One of the key questions of core disruptive accident analysis is if core meltdown inevitably leads to a bottled-up core situation with its energetics potential or if various phenomena exist (as material discharge of hot fuel through the axial blankets, drop-in of blanket material into the core region, etc.) that prevent the accident progression into a bottled-up transition phase pool. The analyses for the specified reactor design show that, taking into account the aforementioned phenomena, the dominant accident path will lead to the postaccident heat removal phase directly from the pretransition phase. The accident path into the transition phase with a bottled-up core situation and its energetics potential might thereby be avoided.

37722 **Observation of ionic sodium uranate precursors in a laser simulation of the conditions inside the bubble formed in an HCDA of an LMFBR.** Zanotelli, W.A.; Craven, S.M.; Hercules, D.M.; Miller, G.D.; Modderman, W.E.; Novak, F. (Monsanto Research Corporation, Mound Facility, Miamisburg, Ohio). *Nuclear Science and Engineering;* **85**: No. 1, 17-25(Sep 1983).

The conditions inside the bubble formed in a hypothetical core disruptive accident (HCDA) of a liquid-metal fast breeder reactor have been simulated with a LAMMA 500 laser microprobe mass analyzer. Results for $Na_3U_2O_7$ show that negative diuranate and positive sodium uranate ions are produced. Higher laser powers

favor greater fragmentation to U^+, $(UO)^+$, and $(UO_2)^+$. The Na_2O/UO_2 results indicate vapor phase reactions result in the formation of positive and negative sodium uranate ion intermediates. Positive hydrogen ions are observed in some spectra. Higher laser energies (higher HCDA temperatures) favor sodium uranate ion formation. These data support the view that sodium uranate ionic precursors are formed in the vapor phase, bubble, of a simulated HCDA reaction. A prior argon-ionexcited secondary ion mass spectroscopy investigation of Na_2O/UO_2 and $Na_2U_2O_7$ showed no sodium uranate species, only the formation of U^+, $(UO)^+$, and $(UO_2)^+$.

37723 **Analysis of results from a loss-of-offsite-power-initiated ATWS experiment in the LOFT Facility.** Varacalle, D.J.; Giri, A.M.; Koizumi, Y.; Koske, J.E. (EG and G Idaho Inc., Idaho Falls, ID). *American Society of Mechanical Engineers, [Paper];* **83-HT-14**: 8(Jul 1983).

An anticipated transient without scram (ATWS), initiated by loss-of-offsite power, was experimentally simulated in the Loss-of-Fluid Test (LOFT) pressurized water reactor (PWR). Primary system pressure was controlled using a scaled safety relief valve (SRV) representative of those in a commercial PWR, while reactor power was reduced by moderator reactivity feedback in a natural circulation mode. The experiment showed that reactor power decreases more rapidly when the primary pumps are tripped in a loss-of-offsite-power ATWS than in a loss-of-feedwater induced ATWS when the primary pumps are left on. During the experiment, the SRV had sufficient relief capacity to control primary system pressure. Natural circulation was effective in removing core heat at high temperature, pressure, and core power. The system transient response predicted using the RELAPS/MOD1 computer code showed good agreement with the experimental data.

37724 **Results and analysis of a loss-of-feedwater induced ATWS experiment in the LOFT Facility.** Grush, W.H.; Koizumi, Y.; Woerth, S.C. (EG and G Idaho Inc., Idaho Falls, ID). *American Society of Mechanical Engineers, [Paper];* **83-HT-15**: 8(Jul 1983).

An anticipated transient without scram (ATWS), initiated by a loss of feedwater, was experimentally simulated in the Loss-of-Fluid Test (LOFT) pressurized water reactor (PWR). Primary system pressure was controlled using a two-position actuator relief valve to simulate a scaled power-operated relief valve (PORV) and safety relief valve (SRV) representative of those in a commercial PWR. Auxiliary feedwater injection was delayed during the experiment until the plant recovery phase where long-term shutdown was achieved by an operator-controlled plant recovery procedure without inserting the control rods. The system transient response predicted by the RELAP5/MOD1 computer code showed good agreement with the experimental data.

37725 **A feasibility study on feed and bleed for pressurized water reactors.** Yi-Shung Chen; Shimeck, D.J.; Sullivan, L.H. (US Nuclear Regulatory Commission). *American Society of Mechanical Engineers, [Paper];* **83-HT-16**: 8(Jul 1983).

By injecting coolant with a high pressure emergency core cooling system, and removing the heated/ vaporized fluid by way of the pressurizer power operated relief valve, primary feed and bleed cooling denotes an operation whereby reactor core cooling is maintained. This paper presents the results from an experimental and analytical study that includes a simplified analysis of mass and energy balances associated with the feed and bleed, examination of test data from the Semiscale system, RELAP5 code analyses of both Semiscale and a four-loop Westinghouse plant, and the primary coolant system behavior for a transient that leads to the need for feed and bleed. Examination of the parameters that govern a stable feed and bleed operation identifies four key parameters such as: core decay heat, cooling water injection capacity, power operated relief valve (PORV) energy removal rate, and PORV mass removal rate. A simplified analytical approach to determining if stable feed and bleed is feasible, has been developed and corroborated by experimental data and computer code calculations. The Semiscale tests have not only provided test data for code assessment, but also have identified the factors influencing the PORV discharge, which is the most variable of the boundary conditions influencing feed and bleed. The RELAP5 computer code has demonstrated the capability of predicting the Semiscale experiments, and when applied to a four-loop Westinghouse plant has indicated that primary feed and bleed is a viable cooling mechanism. This has also been shown by using the simplified analytical method.

37726 **Buckling and post-buckling behavior of the ACS support columns.** Kennedy, J.M.; Belytschko, T.B. (Argonne National Lab., IL). *Nuclear Engineering and Design;* **75**: No. 3, 323-342(Jun 1983). (CONF-830867—).

From 7. international seminar on computational aspects of the finite element method; Chicago, IL, USA (29 Aug 1983).

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Computer program development and modeling procedures for above-core structures (ACS) have recently focused on modeling the buckling and post-buckling behavior of the ACS support columns. These developments are directed toward two considerations: (1) the prediction of the forces exerted by the column in a hypothetical core-disruptive accident (HCDA) in order that the motion of the ACS can be predicted in a coupled fluid-structure analysis, (2) the calculation of the strains and deformations of the support columns so that situations which lead to complete failure can be identified. One of the aims of this study was to examine the effect of the change in cross section, previously not treated, on the behvior of the support columns. For this purpose, models have been developed in which the portions of the column which undergo significant changes in cross section are modeled by plate elements. Results are presented for two sets of studies. In the first set, results are presented for a series of Stanford Research International scale model tests. Comparison of the tests with the computed results shows reasonable agreement. In the second, the column was displaced with a constant velocity at one end to examine its resistance as a function of displacement. The behavior of support columns consisting of two concentric cylinders has also been studied. The interesting feature of this design is that when one of the cylinders buckles, it moves laterally against the other, which may not have buckled. An effective but simple model was developed for representing the interaction between the columns. Results are presented for an HCDA corresponding to a release of 1000 MJ.

37727 **(DOE/RL/10153—T1-Vol.8-Pt.2) Shippingport Station decommissioning project decommission plan.** (Burns and Roe Industrial Services Corp., Paramus, NJ (USA); Nuclear Energy Services, Inc., Danbury, CT (USA)). 1983. Contract AC06-80RL10153. 300p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84010913.

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This volume consists of the following appendices: long-lead-time activities, technical baseline, assessment of one-price removal of reactor vessel and internals by barge, final environmental impact statement (this forms the bulk of this volume), and record of the decision to decommission Shippingport. (DLC)

25 ENERGY STORAGE

2502 Compressed Gas

37728 **Monitoring cyclic load effects on rock salt in situ.** Gehle, R.; Thoms, R.L. (Louisiana State Univ., Baton Rouge). *Series on Rock and Soil Mechanics;* **8**: 334-345(1984). (CONF-811036—).

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

Acoustic emissions (AE) were monitored from a pressurized borehole in rock salt. The borehole, one of a series for in situ tests for compressed air energy storage, was located in the Cote Blanche salt mine in south Louisiana. Acoustic emissions signals received demonstrated a pronounced increase in activity at the crossing of a distinct pressure theshold. Some correlation of increased AE to salt movement was detected.

2506 Thermal

37729 **(EPRI-EM—3159-SR) Opportunities in thermal-storage R & D.** Hausz, W.; Berkowitz, B.J. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA)). Jul 1983. 396p. (CONF-830142—; CONF-830122—). NTIS, PC A17/MF A01. Order Number DE83902534.

From Electric Power Research Institute workshop on thermal storage; Palo Alto, CA, USA (17 Jan 1983).

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Separate abstracts were prepared for papers presented in the following areas of interest: (1) heat storage, including sensible heat storage materials and phase change materials; and (2) cold storage, including icemaking, dehumidification, and advanced concepts.

37730 **(LBL—17816) Aquifer storage simulation - in theory and in practice.** Tsang, C.F. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 12p. (CONF-830670—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014575.

From International conference on subsurface heat storage in theory and practice; Stockholm, Sweden (6 Jun 1983).

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The paper reviews the various uses of simulation studies by means of mathematical modeling in the area of aquifer thermal energy storage. A discussion is given of the governing equations and the key elements and alternative assumptions that enter into these equations. A numerical model used by Lawrence Berkeley Laboratory is then described and its validation discussed. Recent applications of this model to make a priori predictions of a series of field experiments are then presented. Thus this paper attempts to summarize the aquifer energy storage simulation studies from theory to practice.

37731 **(NP—4770422) Thermal energy storage.** (Verein Deutscher Ingenieure (VDI) - Gesellschaft Energietechnik, Duesseldorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung). 1983. 259p. (In German). (CONF-8303162—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84770422.

From Seminar on thermal energy storage; Munich, F.R. Germany (16 Mar 1983).

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The status report presented here provides information on developmental work and results obtained in the projects sponsored within the framework of the Programme "Energy supply and technology". Eight projects are associated with large heat storage systems, 6 on the application of heat storage systems, and 4 on latent and thermochemical heat storage systems.

37732 **(NP—4770431) Heat transport in melting media with consideration given to the processes occurring in latent heat storage.** Bareiss, M. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 6 Dec 1982. 176p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770431.

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During melting, natural convection in the liquid phase plays an important role. On the one hand it leads to an acceleration in melting through the intensifications of heat transport and on the other, because of its locally dependent heat transfer characteristics it has a marked influence on the phase boundary form. The aim of this dissertation was to clarify these relationships on a quantitative basis and to describe them in an appropriate fashion. To this end a series of experiments were carried out on the melting process of the following: 1) at a vertical, heated wall, 2) in a vertical, cylindrical container and 3) in a horizontal tube with a) fixed solid material and b) non-fixed solid material. All processes, with the exception of the last which forms a special case, have in common the fact that heat transfer to the melting material only occurs by conduction at the beginning. With increased spreading of the liquid area natural convection takes over as heat transfer mechanism, whereby the transition from conductive to convective melting mechanism usually occurs quite fast. Suitable criteria could be found to determine this transition point with regard to the geometrical relationships.

2508 Chemical

REFER ALSO TO CITATION(S) 25080037731

2509 Batteries

37733 **(ANL/OEPM—84-1) Effects of additives and KOH electrolyte concentration on dissolution of iron electrodes.** Poa, D.S.; Miller, J.F.; Yao, N.P. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014840.

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The effects of additives (K_2S, LiOH, and FeO) and KOH concentration on electrochemical dissolution of iron electrodes in KOH electrolytes were investigated, using a rotating ring-disc electrode. Experimental results were analyzed on the basis of changes of characteristic disc and ring currents and variation of Fe(II) species supersaturation at the disc electrode surface. In 8 to 10 M KOH solutions, both the dissolution rate of iron to form soluble Fe(II) species and the irreversibility of the electrode redox processes are high. In 0.5 to 4 KOH solutions, reversibility of the electrode redox processes is better, but active dissolution of iron remains high. When the iron electrode is operated in 5 to 7.5 M KOH solutions, active dissolution to form soluble Fe(II) species is low during both charge and discharge, and the reversibility of the electrode redox processes is higher than in 8 to 10 M KOH solutions. When K_2S is added to the electrolyte, the supersaturation of soluble Fe(II) species increases sharply, the reversibility of the iron electrode redox processes appears improved, and the H_2 gas evolution overvoltage increases by 100 to 150 mV. When LiOH is added to the electrolyte, the anodic and cathodic dissolution of the iron electrode, forming soluble Fe(II) species, as well as the formation of solid film products at the electrode surface, may be significantly decreased; whereas the reversibility of the iron electrode redox processes may be increased. Saturation of the KOH electrolyte with FeO may cause significant changes in the mechanisms and reaction rates of iron dissolution, because of the competing oxidation-reduction of Fe(II) species, which become more available at the electrode surface. However, the influence of FeO saturation on the dissolution of iron in the form of soluble Fe(II) species is probably not significant.

37734 **(CONF-831272—4) Battery optimization considerations.** Walsh, W.J.; Marr, W.W. (Argonne National Lab., IL (USA)). 1983. Contract W-31109-ENG-38. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014759.

From EHV systems assessment seminar; Gainesville, FL, USA (14 Dec 1983).

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During the past three years, Argonne National Laboratory (ANL) has developed a computerized method for establishing battery requirements for electric vehicles. This system, which is called Eva (Electric Vehicle Analysis), enables least-cost analyses for optimizing battery characteristics tailored to specific vehicle types and missions. Eva is a user-friendly, interactive software package which allows complex battery and vehicle optimization with relative ease. Key features of Eva include extensive modeling of battery interrelationships and a consistent attempt to avoid premature specification of any parameter. An equation for life cycle cost is derived in terms of mission requirements, battery characteristics, and vehicle factors. Advance specification is limited to electrochemical system, vehicle class, and mission requirements. Eva determines the combination of battery characteristics which results in least cost while fully satisfying the mission requirements. The objective is to establish battery requirements of minimum difficulty which lead to electric-vehicle batteries of satisfactory performance and maximum cost competitiveness.

37735 **(DOE/ER/04356—6) Electrochemical investigations of novel electrode materials. Final report, August 1, 1977-December 31, 1983.** Worrell, W.L. (Pennsylvania Univ., Philadelphia (USA). Dept. of Materials Science and Engineering). Jun 1984. Contract AC02-77ER04356. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014352.

The Group IV and V transition-metal disulfates, e.g. TiS_2, can easily intercalate alkali-metal atoms as a result of their unusual layered structures. The structural, thermodynamic and transport properties of the lithium and sodium intercalated disulfides have been investigated. Electrochemical-cell techniques have been used to determine the compositional variation of the chemical potential and diffusivity of lithium and sodium in TiS_2 and TaS_2. A thermodynamic approach has been used to model the compositional variation of the alkali-metal chemical potential in the intercalated compounds. Using this model, the magnitude of the repulsive interaction energy between intercalated atoms can be estimated. A model which predicts the observed compositional variation of the alkali-metal chemical diffusivity in intercalated compounds has also been derived. The chemical diffusivity model is in good agreement with the experimental results for the Na/sub x/TaS_2 and Na/sub x/TiS_2 systems. Two types of multinary intercalation compounds have been investigated. Phase relationships and lithium chemical potentials in the co-intercalated Li/sub x/Na/sub y/TiS_2, Li/sub x/K/sub y/TiS_2 and Li/sub x/Ca/sub y/TiS_2 systems have been determined. Results from these studies have increased our understanding of the significance of ionic size and charge of a second intercalant upon the structure, phase stability and electrochemical properties of Li/sub x/A/sub y/TiS_2 compounds.

37736 **(EPRI-EM—3453) Development of beta batteries for utility application. Report for July 1981-December 1982.** Roberts, R. (General Electric Co., Schenectady, NY (USA)). Jun 1984. 160p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920445.

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The interim results of an EPRI-sponsored program to develop sodium/sulfur batteries are presented in this report. This work was done under the joint General Electric-Chloride Silent Power Limited Program for the development of Beta Batteries for electric vehicle propulsion and for electric utility energy storage. Current program emphasis is on improving the electric utility cell. This new cell contains the same electrolyte as the NaS7 cell but has not yet yielded the reliability of the NaS7. Causes of performance differences are attributable to scale-up of the sulfur electrode and from yet-to-be-determined sources of mechanical stress in the electrolyte.

37737 **(NP—4770429) Lithium-high power cells with organic electrolytes, molybdenum oxide or chromium oxide as cathode and Li or LiAl as anode.** Heydecke, J. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Chemie, Biologie und Geowissenschaften). 19 Aug 1982. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770429.

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Investigations on cathodic materials related to a) studies on increase in conductivity of CrOsub(x), b) tests of suitability of MoO_3 modifications, and c) the study of cathodic discharge or cyclisation of MoO_3 and CrOsub(x). Further experiments were concerned with d) the cyclisation of a cell: seloxcette/1M $NaClO_4$/PC/Na, e) the preparation of suitable electrolytes, f) Li-precipitation out of organic electrolytes, and g) practice-related cyclisation of a prototype of a CrOsub(x)/$LiClO_4$-PC-DME/LiAl button cell.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 29000037754

37738 **(DOE/AD/11139—T2) Survey of DOE training activities and needs related to quality assurance. Final report.** (TRW Energy Engineering Div., McLean, VA (USA)). 23 Apr 1984. Contract AM01-81AD11139. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014429.

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DOE headquarters; field offices, and contractors at field sites were surveyed to determine: the general requirements and quality assurance (QA) training as perceived by their offices; the type, content, and availability of QA training of those offices; and what new training areas need development. Actual implementation occurred with the contractors, with oversight and verification by DOE employees. Program managers, division directors, and project managers were seen as crucial to any QA effort's success. Conclusions point to the need for more QA programs using both formal and informal training for both QA and non-QA personnel. A balanced mix of project management courses; nuclear needs for QA, and outside courses by sources such as professional societies and universities was stressed. Additional development was urged in the following areas: increasing QA awareness, QA principles, uses of QA, QA for non-QA personnel. Specific courses directed toward: QA auditor training, unusual occurrence reporting, configuration management, QA for research projects, QA for operations, QA application for the design and development of software.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 29010037171, 37179, 37184, 37816, 37849

37739 **(DOE/EI/10691—T4) Tools for analysis of short-term energy outlook projections.** (Native American Consultants, Washington, DC (USA)). Jan 1982. Contract AC01-80EI10691. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013464.

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Forecast accuracy measures were formulated. A computer program was written to calculate and report the accuracy measures. Several forecast analysis computer runs were made to validate the run results. This error analysis tool was the basis for the May, 1981 evaluation of the Short-Term Integrated Forecasting System (STIFS) Motor Gasoline Forecast by the former EIA Office of Access Oversight and Analysis. This report documents the error analysis methodology, the supporting computer routine and some sample run results.

37740 **(EUR—8959-EN) Case study Netherlands: Reference case II.** Valette, P.; Heuvel, P. van den. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 17p. Commission of the European Communities, Luxembourg.

Recent case studies carried out with the sectoral part of the medium term EC energy demand model for the Netherlands are described. The hypotheses used for the macroeconomic model for the Netherlands are presented. These hypotheses have been agreed by national experts. The results of two different simulations which demonstrate the reaction of energy demand to different energy prices and different macroeconomic developments are given. In the second part of the report, the results are compared with those from national forecasts performed at about the same time by the Central Planning Bureau at The Hague. Conclusions are drawn as to the plausibility of results.

37741 **(EUR—8965-EN) Presentation and analysis of national results for reference case II: Ireland.** Henry, E.W. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 58p. Commission of the European Communities, Luxembourg.

This report described the Irish results of Reference Case II, together with background work and information covered by Annexes 1 to 3. There are comparisons of Case I and Case II results and a further comparison of Case II with an economic plan proposed by the previous Irish government in October 1982. A satisfactory conclusion emerging from this comparison is that the Case II fuel shares for 1985 and 1990 are realistic, in the sense of being in close agreement with those proposed in the plan. The latter also reveals decreasing energy/GDP ratios; the plan rate of decrease of 3.4% per year for 1985-87 may be over-optimistic by comparison with the 1985-90 2.2% shown by Case I and the 0.7% of Case II.

37742 **(EUR—8972-EN) EURECA: Current structure and use.** Guillaume, Y. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 15p. Commission of the European Communities, Luxembourg.

The EURECA Model was described in "The macro-economic Energy Model EURECA" by Dramais et al., EUR No. 6772, - since the numerous modifications have been made to it, especially as regards the treatment of energy and other production factors and prices. This report describes these changes to the structure, shows how EURECA is used and contains some simulation results that give the reader an idea of the model's reactions to outside shocks or variations in economic policy.

37743 **(NP—4770418) Peru - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1984. 19p. (In German). NTIS (US Sales Only), PC A02. Order Number DE84770418.

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The energy situation of Peru is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade.

37744 **(NP—4770419) Ghana - energy situation 1982/83.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1984. 8p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770419.

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Developments on Ghana's energy sector are briefly reviewed. Mention is made of energy policy, the situation of petroleum and other energy sources, and external trade.

37745 **(NP—4770420) Pakistan - energy situation 1982/83.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1984. 17p. (In German). NTIS (US Sales Only), PC A02. Order Number DE84770420.

Paper copy only, copy does not permit microfiche production.

The energie situation of Pakistan is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

37746 **(NP—4770421) Austria - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1984. 22p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770421.

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The energy situation of Austria is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payments.

37747 **(NP—4770423) Singapore - energy situation 1979.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1980. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770423.

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A few data are given on power generation, petroleum consumption, fuel prices (gas, electricity and motor fuel), supply assurance, alternative energy sources, and foreign trade.

37748 **(NP—4770424) Qatar - energy situation 1979.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jul 1980. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770424.

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Qatar's only energy sources - petroleum and natural gas - and the structure of the country's energy market are reviewed on the basis of a few relevant data. Energy-relevant projects in Qatar are reviewed. Unofficial data are given on foreign trade (Qatar does not publish an official trade balance).

37749 **(NP—4770428) Iran - energy situation 1983.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1984. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770428.

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Despite the fact that Iran still has not published any official economic statistics, some figures are available after presentation of its 1st five-year plan concerning the energy carriers of mineral oil, natural gas, coal and electricity generation. By and large, the data in this report are based on estimates by Western observers. Detailed analyses cannot be undertaken.

37750 **(NP—4901555) Tennessee energy statistics quarterly, fourth quarter 1983.** Finley, T.F. III; Hensley, B.D.; Trotter, T. (Tennessee Dept. of Economic and Community Development, Nashville (USA). Energy Div.). 1983. 34p. Tennessee Dept. of Economic and Community Development, Suite 207, 510 Gay St., Nashville 37219. Order Number TI84901555.

County-level energy data are shown as well as state statistics on three substantive areas of the energy flow: production; consumption; and pricing. The specific energy types for which data are included are coal, petroleum, natural gas and electricity. Historical data in this volume cover the production and utilization of major energy supplies by fuel type and economic sectors, as well as other energy data such as prices and fuel distribution.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 29020037180, 37181, 37185, 37204, 37209, 37227, 37451, 37866

37751 **(CONF-830526—Summ.) Summary of the second equal opportunity conference.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Equal Opportunity). Feb 1984. 41p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013581.

From 2. equal opportunity conference; Denver, CO, USA (2 May 1983).

Reports and recommendations are included for: Hispanic Employment Program; Federal Women's Program; Equal Employment Opportunity Program; complaint processing workshop; Affirmative Actions Program Workshop; EEO programs in the Office of Personnel Management; and an overall evaluation of the program. (PSB)

37752 **(DOE/MI/02509—T1) Rocky Mountain energy development: employment and business opportunities for native Americans.** (Pacifica Services, Inc., Los Angeles, CA (USA)). Jun 1982. Contract AC01-81MI02509. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014430.

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This study revealed that increasing numbers of American Indians are securing jobs at energy projects on or near their reservations, and that tribal governments and individual members are taking greater advantage of business opportunities associated with large-scale development projects. The Navajo and Northern Cheyenne experience show that the most effective strategy available to the tribes in securing jobs and service contracting opportunities in the energy industry is through the inclusion of Indian preference provisions in agreements with energy companies. The Navajo have developed explicit tribal policies and procedures for negotiating such agreements, with the result that Navajo employment in coal and uranium mining and processing operations on or near the reservation is as high as 75% and averages around 20% of the total labor force at these facilities. Eight specific recommendations are included.

37753 **(DOE/MI/10023—T3) Cooperative Developmental Energy Program. Final report.** Smith, L.S.; Anthony, J.L.; Crawford, B. Jr.; Grissom, W.A.; Washington, W.J. (Central State Univ., Wilberforce, OH (USA)). Jun 1984. Contract FC01-83MI10023. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84013815.

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This effort seeks to establish a program for the enhancement of growth and opportunities for minority businesses, to provide a mechanism for job creation for minorities in the energy field, and to review the educational curriculum at Central State University in order to provide better training for the entry of students interested in energy technology careers. This report describes such events as the identification of the problems, analysis of data and development of strategies to enhance the penetration of minorities in the energy field. This report addresses these objectives, and provides the background for a follow-on program.

37754 **(PB—84-173483) President's Private Sector Survey on Cost Control: report on the Department of Energy, the Federal Energy Regulatory Commission and the Nuclear Regulatory Commission.** (President's Private Sector Survey on Coast Control, Washington, DC (USA)). 1983. 211p. NTIS, PC E06/MF A01.

The report represents the results of the Department of Energy/Federal Energy Regulatory Commission/Nuclear Regulatory Commission Task Force of the President's Private Sector Survey on Cost Control in the Federal Government. The Report on the Department of Energy contains major recommendations which, when fully implemented, could result in three-year cost savings and revenue generation of $4,085 million and three-year cash accelerations of $89 million. It should be noted, however, that some of the recommendations may require several years for the savings and revenue to be realized. While all facets of the Department of Energy could not be surveyed in the time allotted, areas selected for review were considered to offer significant potential for cost control and improved efficiency.

37755 **(PB—84-185420) Energy use and taxation policy in the New Zealand car fleet.** (New Zealand Energy Research and Development Committee, Auckland). Feb 1984. 51p. (R—101). NTIS, PC E04/MF E01.

Errata sheet inserted.

The report describes the composition of the New Zealand car fleet and the relationship between design factors, fleet composition, vehicle useage and fuel consumption. The indirect energy content of the vehicle and roadway are discussed. Existing and potential Government policy instruments for promoting fuel economy in the car fleet are discussed and evaluated. The report conclusions favor flat rate sales tax on vehicles regardless of engine size together with an appropriate level of petrol tax in preference to taxation that varies with vehicle size or engine capacity. A review of hire purchase regulations is proposed. Prior to publication of this report the Industries Development Commission Plan for the motor vehicle industry was released which proposes changes to the tariff, taxation and credit purchase regime applying to motor vehicles. These changes are summarized.

37756 **Analysis of heterogeneity in residential-sector fuel prices at various levels of aggregation.** Nieves, L.A.; Secrest, T.J. (Pacific Northwest Lab., Richland, WA). *Energy Systems and Policy;* 8: No. 2, 183-211(1984). Contract AC06-76RL01830.

This paper examines the statistical justification for using aggregate residential fuel prices (electricity, natural gas, and No. 2 fuel oil) and escalation rates. A variance and covariance analysis of cross-sectional, time series, fuel price data is undertaken to explore the justification for pooling data across successively larger regions. The results indicate that use of national average prices and escalation rates is not statistically justified for any of the fuels. In addition, both average fuel prices and average escalation rates for DOE regions and states are found to be poor indicators of price distributions within such regions in about one-third of the cases examined. 5 references, 6 figures, 4 tables.

37757 **Tax incentives for new energy technologies.** Washington, DC; Government Printing Office (1983). 350p.

A hearing on tax incentives to encourage alternative energy technologies brought testimony from representatives of the synthetic fuels, solar, and cogeneration industries, and from consultants who have analyzed the costs of small power generating technologies, including renewable energy sources, geothermal, cogeneration, and fuel cells. In defense of tax credits, witnesses pointed to the high capital costs of developing and commercializing these new technologies. Private funding, they noted, is often a response to tax incentives. An appendix with additional statements for the record follows the testimony.

37758 **Stabilization theory, regulatory policy, and the investment preferences of utility shareholders.** Kahn, E. (Lawrence Berkeley Lab., CA). *Energy Systems and Policy;* 8: No. 3, 237-267(1874).

The strategic interests of electric utility shareholders and the policies of regulators are modeled as price-stabilization problems. Pervasive supply and demand uncertainties in the utility industry emphasize the need for stabilization. Consumers were the principal beneficiaries of stabilized prices in the 1970s. Shareholders have borne the cost of previous oil cost and demand variability. Consequently, they stand to benefit most from future stabilization actions by regulators. Three generic production strategies for utilities are examined to determined where the greatest stabilization value lies. These strategies are: traditional regulated supply projects, unregulated production, and utility conservation programs. Stabilization policies have their greatest value for unregulated production. Utility conservation programs are superior to traditional regulated supply projects provided that conservation "output" can be controlled. If utility conservation programs have a large unmanageable variability, they will cause shareholder losses. 33 references, 2 figures, 9 tables.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 29030037188, 37510, 37810, 38405, 38419, 38420, 38421, 38439, 38471, 38475, 38560

37759 **(PB—84-185263) Iowa Department of Water, Air, and Waste Management annual report, 1983.** (Iowa Dept. of Water, Air and Waste Management, Des Moines (USA)). 1984. 24p. NTIS, PC A02/MF A01.

See also PB82-192725.

The 1983 Annual Report discusses the Iowa Department of Water, Air and Waste Management's major activities and programs. Iowa's environmental achievements are highlighted, and the major areas covered are: WAWM Commission and Organization, Water, Financial Assistance Offered for Construction of Waste Water Treatment Facilities, Water Studies Being Done in Cooperation with Other Agencies, Iowa Operator Certification Program, Air, Waste, A View Towards the Future and Proposed Legislation.

37760 **EPA's law enforcement authority. Hearing before the Subcommittee on Oversight and Investigations, House of Representatives, Ninety-Eighth Congress, First Session, December 19, 1983.** Washington, DC; Government Printing Office (1984). 145p.

Criminal investigators from the Environmental Protection Agency (EPA) and its field offices testified at a hearing on whether EPA has sufficient authority to investigate criminal violations, particularly in the area of illegal disposal of hazardous materials. They reported on the agency's progress in staffing a unit with authority comparable to that of Customs and the FBI. The Justice Department opposed deputizing EPA investigators, but the committee found that investigators in the 22 states surveyed operate with law-enforcement powers. Material submitted for the record by EPA, the Justice Department, and others follows the testimony of 10 witnesses.

2904 Natural Resources

REFER ALSO TO CITATION(S) 29040037171, 37763, 37875, 37917

37761 **(TVA/PUB—84/49) Floodplain management: the TVA experience.** Goff, C.; Porter, D.; Wardell, P.; Wright, J. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources and Economic Development). Dec 1983. 82p. NTIS, PC A05/MF A01. Order Number DE84901612.

This report presents the history of TVA's Floodplain Management Program, citing experiences and accomplishments which indicate the program's effectiveness in reducing flood damage in the Tennessee River watershed. 66 references, 25 figures.

37762 **Energy and Water Development Appropriations for 1985. Part 8. Testimony of members of Congress and other interested individuals and organizations. Hearings before the Committee on Appropriations, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 1605p.

Part 8 of the hearing record covers the testimony of members of Congress and interested individuals and organizations. This volume begins with comments on Texas projects, but also covers projects in several states relating to navigation and flood control, nuclear waste disposal, renewable energy, energy storage system, and other projects in several states. The witnesses represented energy companies, state and local officials, environmental and other citizen groups, as well as the members of Congress.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 29050037757, 37762, 37911, 37917

37763 **Energy and Water Development Appropriation Bill, 1985. Report submitted by Committee on Appropriations, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 172p.

The House Committee on Appropriations summarizes the status of 1984 appropriations for 1984 and submits its estimates and recommendations for 1985 appropriations for the Departments of Defense (Civil), Interior, and Energy and for independent agencies. The estimated budget for Title I through IV items is $15.9 trillion, compared to $14.5 trillion in 1984. The committee recommends $15.5 trillion. The report reviews the budgets in each category and summarizes the hearings.

37764 **Department of Energy Civilian Applications Authorization Act, fiscal years 1985 and 1986. Report presented by the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 109p.

The committee recommends an amended version of H.R. 5048, which authorizes DOE appropriations for civilian applications for fiscal years 1985 and 1986. The bill, as introduced, restores the balance to energy programs, but still keeps spending levels below 1981 in keeping with the administration's policy. It shifts some of the increased spending requests for nuclear fission and fusion back to partially restore cuts in conservation, fossil, and solar energy budgets. The report covers background on the need for legislation, details of the authorization, a summary of the hearings and committee debate, a section-by-section analysis of the amended bill, and a summary of the assenting and dissenting views.

37765 **SBA energy loan program.** Washington, DC; Government Printing Office (1982). 126p.

Representatives from small energy businesses testified on how legislation to provide loan funds has been implemented following complaints that applicants have been turned away from some local loan offices. The committee questioned why the program has only used $1 million of the $25 million, and why there has been so little activity. An overview of the program was presented by Edwin Holloway of the Small Business Administration, who noted that the solar and insulating materials industries accounted for 70% of the loans to date during its first year. He also noted that high interest rates and the reluctance of small businessmen to borrow money during the recession of 1981-1982, combined with the regulatory paperwork, were responsible for the low activity level. A panel discussion included representatives of wind power, solar, and energy conservation interests. Additional statements and responses as well as nine appendices with supporting material follow the testimony.

37766 **Department of Energy fiscal year 1983 national defense programs authorization.** Washington, DC; Government Printing Office (1982). 211p.

Herman Roser of DOE Defense Programs, Richard Wagner of the Defense Department (Atomic Energy), Admiral McKee of DOE Naval Reactors, and the directors of the Los Alamos, Sandia, and Lawrence Livermore Laboratories testified at a hearing to consider S. 2286, which authorizes appropriations for DOE national security programs. The witnesses described these programs and progress made at the research level in justifying the budget levels. The laboratory directors explained specific weapons research and the process of entering new weapons systems into the defense system.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 29060037222, 37226, 37227, 37268, 37340, 37357, 37358, 37370, 37619, 37620, 37802, 38378, 38560, 39025

37767 **(INIS-mf—8963) Summary of nuclear power and fuel cycle data in OECD Member countries.** (Nuclear Energy Agency, 75 - Paris (France)). Mar 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701629.

A questionnaire on Electricity Generation, Nuclear Power and Fuel Cycle Data is distributed annually to OECD Member countries. Member countries were asked to provide, where available, various statistics for the previous calendar year (1982) and modified projections up to the year 2000. Tables 1 to 8 are based on the responses received and update the March 1982 issue. Tables 3 to 8 show the revised electricity, nuclear power and fuel cycle supply and demand projections in OECD Member countries to the year 2000. Figure 1 illustrates the contribution of the different fuel sources to the OECD's electricity generation from 1974 to 1982. Figure 2 shows the nuclear share of electricity generation in the OECD countries for 1982 and 1985. Figure 3 gives the fuel cycle supply and demand from the Tables 5, 6 and 8 in the OECD area.

37768 **(INIS-mf—9033) Summary of the law relating to atomic energy and radioactive substances.** Sim, D.F.; Ritchie, K.J.S. (UKAEA Headquarters, London). Apr 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780534.

Intended as a signpost to the relevant law no aspect is covered in detail but a full summary is given. For further details reference has to be made to Acts or regulations themselves. The summary covers the Common Law, the laws in force, regulations under the Factories Act 1961, regulations and orders relating to food and medicines, those concerned with the transport of radioactive materials, regulations under the Social Security Act 1975, Control of Import and Export, the Euratom treaty, important non-statutory codes of practice etc., international conventions, regulations etc. relating to the peaceful use of atomic energy and radioactive substances in which the UK is interested and finally, foreign legislation. The details have been revised as at 31 March 1983. (U.K.).

37769 **(PER—79) Transfer of industry-oriented nuclear technology at NUCOR.** De Jesus, A.S.M. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Oct 1983. 210p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84702578.

The transfer of industry-oriented nuclear technology at the Nuclear Development Corporation of South Africa (Pty) Ltd (NUCOR) is centred in a few divisions only, as most of the NUCOR's program is internally oriented. The industry-oriented activities include radiation technology, production of radioisotopes and application of nuclear techniques in solving problems of industry. The study is concerned mainly with the last of these activities. The general problem of transferring innovative technology is reviewed and a systems approach is used to analyse the transfer process at NUCOR, in terms of the organisation itself and its environment. Organisational strengths and weaknesses are identified and used as a basis to determine opportunities and threats. Possible objectives are formulated and a strategy to meet them is suggested. 'Demand-pull' as opposed to 'technology-push' is advanced as the

main triggering mechanism in the transfer of industry-oriented nuclear technology. The importance of marketing this technology, as well as its commercialization, are discussed.

37770 **Public opinion and nuclear energy.** Nealey, S.M.; Melber, B.D.; Rankin, W.L. Lexington, MA; D.C. Heath and Company (1983). 209p. (DOE/NBM—4014414). Lexington Books, D.C. Heath and Company, Lexington, MA. Order Number TI84014414.

Public acceptance of a nuclear power plant (NPP) built near one's residence has declined steadily since the early 1970's. Following the TMI accident, this acceptance decreased dramatically. There has been some attitude rebound, however, and through mid-1981, the % who supported continued NPP construction in USA was 5 to 10% more than those in opposition. Men's and women's attitudes are different and were differentially affected by the TMI accident. Beliefs and attitudes about specific nuclear power issues were explored using questionnaires. Reactor-safety concerns were found to be more important than nuclear-waste concerns. Nuclear fuel-supply considerations are believed to be a major advantage of nuclear power. The public was largely unaware of the breeder-reactor concept. The US public generally does not favor selling US reactors abroad. It also greatly underestimates how long it takes to build a NPP. Most people believed solar-generated electricity is cheapest. The public has little information or has misinformation about some areas of nuclear power. (DLC)

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 29080037879, 38141

37771 **(PB—84-188283) Performance specification for a total energy plant at the Jersey City BREAKTHROUGH I site.** (National Bureau of Standards, Washington, DC (USA). Inst. for Applied Technology). 28 Dec 1970. 0021p. NTIS, PC A02/MF A01.

These performance specifications for a total energy plant for the HUD BREAKTHROUGH I site at Jersey City, N.J., cover the project's economics, design requirements, potential future expansion, integration of service systems, and quality assurance. The total energy plant consists of the mechanical equipment for energy generation, conversion, and transfer; the building for housing the mechanical equipment; and the system for distributing the utilities to the dwellings and other buildings on the site. The guidelines on design cover the calculation of design loads, fuel, equipment selection, system reliability, stability of electrical service, maintenance requirements, noise and vibration control requirements, and air pollution control. Also covered are the thermal environment and ventilation, aesthetic requirements, illumination requirements, safety requirements, suppression of magnetic interference, and distribution systems. An appendix presents an interface matrix showing system components and performance attributes and a list of standards related to fire, safety, explosions, and protection against equipment failures.

2910 Conservation

REFER ALSO TO CITATION(S) 29100037765, 37809, 37837, 37848, 37850, 37883

37772 **(DOE/MA—0004/3) FY 1983 annual report on in-house energy management .** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). Jul 1984. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014798.

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A summary of energy conservation activities and an evaluation of progress toward the achievement of consumption and efficiency goals is presented. All DOE Field offices are included. 34 figures.

37773 **(NP—4770426) Micro- and macroanalysis of the effects of summer time on the energy and power demand in the various energy consumption sectors of the F.R. of Germany.** Bouillon, H. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 2 Feb 1983. 169p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770426.

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At the beginning of the thesis a fundamental survey of the structure and development of the energy consumption in the F.R. of Germany is given. Subsequently, an analysis of the effects of summer time on the lighting power consumption in households by the help of a simulation programme is made. The following chapters present microanalyses of the effects of summer time on the electric power consumption of households by the help of practical measuring results, on the lighting power consumption in households by the help of a simulation programme is made. The following chapters present microanalyses of the effects of summer time on the electric power consumption of households by the help of practical measuring results, on the lighting power consumption in administration and office buildings as well as industrial buildings and on performance rates and electric power consumption as exemplified by various electric utility companies. Finally, the effects of time lags on the heating energy consumption as well as the effects of summer time on road traffic are analyzed.

37774 **(PB—84-181999) Integrated gas-fired space heating/water heating system with electric air conditioning. Annual report on phase 1, Jan-Dec 83.** Vasilakis, A.D.; Celorier, G.M.; Gerstmann, J. (Advanced Mechanical Technology, Inc., Newton, MA (USA)). Jan 1984. 92p. NTIS, PC A05/MF A01.

The marketability of a gas space and water heating system combined with an electric air-conditioning system has been examined. This has included a cost effectiveness evaluation when compared to competing systems. The concept appears feasible using a three-year payback criteria. An engineering prototype was constructed which demonstrated space heating efficiencies in the high eighties and water heating recovery efficiencies in the low to mid eighties.

37775 **Current problems in energy management.** Mashburn, W.H. pp 443-444 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

Current problems faced by energy managers in the areas of legislation and technology can be met by various strategies. Some things, such as fuel switching, alternative financing, and rate structure change, can be done immediately. Generally, however, the major effort of the energy manager should be to develop a strategic plan with these components: executive summary, situation analysis, energy requirements, energy requirements and costs, issues, objectives, and strategies identification, action program, planned results, and evaluation of sensitivities and assumptions.

37776 **Microcomputer applications in energy management.** Benator, B.I. pp 221-226 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

This paper explores the ways in which the use of microcomputers can help managers and design professionals manage their energy costs in the following ways: verification and analysis of utility bills, automatic calculation of BTUs from kwh, therms, pounds of steam, gallons of oil, automatic calculation of Energy Utilization Index (EUI) in BTU/sq. ft./yr., graphical analysis of utility bills, life cycle costing of energy conservation opportunities, and building energy analyses using public domain and/or commercially marketed programs.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 29200037165, 37166, 37182, 37183, 37202, 37739, 37790

37777 **(DOE/EI/10422—T1-Vol.2) Assessment of residential energy consumption data and their use in forecasting models. Volume II. An assessment of the NIECS.** Blumstein, C.; York, C.M.; Kemp, W. (California Univ., Berkeley (USA). Energy and Resources Group). Jul 1981. Contract AC01-80EI10422. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015138.

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Information related to energy use was collected from a representative national sample of households. This information included types of fuel, equipment used, and housing characteristics such as size and the amount of insulation. Data on actual energy consumption was obtained from records maintained by the households' fuel suppliers. A description and an analysis of the survey methodology and results are presented. The sample design, the conduct of the survey, and data preparation and editing are examined. Results from early and late respondents to the survey are compared to evaluate the effects of the multi-wave, multi-contact interviewing approach used in the survey. The most useful method was a comparison between survey responses and the findings of a field research effort to verify responses for a small sample. Recommendations are included for sampling improvements.

37778 **(DOE/EI/10422—T1-Vol.3) Assessment of residential energy consumption data and their use in forecasting models. Volume III. Data and models, a comparison of the ORNL and CEC models.** Weatherwax, R.K.; Conley, F.C.; Hudson, K.; McGuire, C.B.; Rosse, J.S.; York, C.M. (California Univ., Berkeley (USA). Energy and Resources Group). Jul 1981. Contract AC01-80EI10422. 267p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84015140.

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Historical development of microeconometric energy end-use forecasting models, their interaction with data bases, detailed descriptions of the Oak Ridge National Laboratory (ORNL) model and the California Energy Commission (CEC) model, a comparison of the two, and a discussion of the value of information to decision making are reviewed.

37779 **(DOE/EI/10422—T1-Vol.4) Assessment of residential energy consumption data and their use in forecasting models. Volume IV. A. Documentation of the ORNL model. B. Documentation of the CEC model.** Hudson, K. (California Univ., Berkeley (USA). Energy and Resources Group). Jul 1981. Contract AC01-80EI10422. 190p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84015143.

Portions are illegible in microfiche products.

37780 **Mobilization fuel requirements.** Washington, DC; Government Printing Office (1981). 26p.

Richard D. Webster, Deputy Assistant Secretary of Defense, logistics and material management, was the principal witness at a hearing held to examine the Defense Department's mobilization planning in terms of fuels. Webster explained how the military departments estimate and maintain fuel stocks based on fuel requirements for individual weapons systems. He also described peacetime activities in securing adequate fuels for operating and reserve stock. Portions of the hearing contained classified material, making it necessary for an executive session and for deletions in the hearing record.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 29300037172, 37191, 37198, 37203, 37226, 37268, 37340, 37357, 37358, 37486, 37743, 37744, 37745, 37746, 37747, 37748, 37749, 37757, 37760, 37762, 37763, 37764, 37766, 37780, 37786, 37805, 37815, 37849

37781 **(DOE/CE—0023/3) Comprehensive program and plan for Federal Energy Education, extension and information activities: annual revisions. Seventh report to Congress.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). May 1984. 114p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84014401.

Federal incentives relating to energy in effect during FY 1983 are discussed. Federal agencies with energy information activities in 1983 are listed. A catalog of audiences and services is presented. Legislative reporting provisions and an annotated directory of agencies and activities are included. (MHR)

37782 **(PB—84-185727) Multi-criteria decision analysis as an aid to strategic planning of Energy Research and Development.** Lootsma, F.A.; Meisner, J.; Schellemans, F. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1984. 54p. (R—84-02). NTIS, PC E04/MF E01.

This paper demonstrates the use of multi-criteria decision analysis as an aid for an advisory council to select areas of interest for government-financed Energy R and D subject to a budget constraint. The socio-economic benefits of Energy R and D in a particular area may be difficult to value in monetary terms. A way of comparing the anticipated impact of Energy R and D in different technological areas based on the opinions of the council members given a number of judgment criteria is described, followed by maximizing the overall impact of an Energy R and D program for a given level of expenditure. Since the council members have different backgrounds, their opinions may diverge and so may the solutions of the optimization problem. It is shown how the decision model can be used as a discussion model highlighting the points of agreement and disagreement amongst them, so that they can concentrate on the latter in order to reach a vindicated compromise.

37783 **Facilitating commerce by the domestic renewable energy industry and related service industries.** Washington, DC; Government Printing Office (1983). 14p.

The House Committee report on H.R. 3169 recommends passage with the addition of one amendment. The bill amends the Energy Policy and Conservation Act to require the Secretary of Commerce to evaluate the market and possible barriers to the domestic renewable energy sources industries. Following the evaluation, the Secretary would institute a program to enhance commerce in this area. The committee's recommended amendment adds six months after the date of enactment and May 31, 1985 for implementation. The report explains the background of the bill, its legislative intent, and committee findings.

37784 **French energy policy: prospects for the future.** Bodelle, J. pp 455-459 of Advances in energy cost savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

France faces an enormous challenge in the field of energy because it has a heavy global dependency, a dependency on foreign sources for crude oil, and a geology that does not hold exceptional promise for the future. The main goal of French energy policy is therefore to increase selfsufficiency by means of the rational use of energy (conservation), the use of energy substitutions, increasing domestic production, and the nuclear program. A major effort of research and development is also being planned.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 29400037165, 37166, 37172, 37179, 37180, 37181, 37182, 37183, 37184, 37185, 37189, 37190, 37191, 37192, 37193, 37193, 37198, 37200, 37202, 37203, 37204, 37209, 37790

37785 **(DOE/ET/14331—T1) Cost and market analysis of advanced fossil fuel extraction technologies. Final report.** (Mitre Corp., McLean, VA (USA). Energy Conversion Dept.). 2 Apr 1981. Contract AC01-80ET14331. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013615.

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An outline of the briefing given by Mitre to the Deputy Assistant Secretary for Oil, Gas, and Shale Technologies on the economic impacts of incentives for EOR production, and analysis of the value of refineries of feedstocks obtained from heavy oil, oil shale, light oil from EOR processes and tar sands. The activities to be conducted and the level of effort for each work area is described.

37786 **(NCB-P—1) Coal price prospects and availability of coal in the U.K. power generation market. Sizewell B public inquiry: proof of evidence.** Parker, M.J. (National Coal Board, London (UK)). Feb 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701627.

The availability and cost of National Coal Board coal is discussed with respect to the CEGB's economic case for Sizewell B nuclear power station. It is concluded that an investment which depended for its viability on an early or rapid escalation in international coal prices, or upon this escalation continuing indefinitely into the future, would not be sound.

2960 Electric Power

REFER ALSO TO CITATION(S) 29600037226, 37758, 37774, 37812

37787 **(DOE/EIA—0095(83)) Inventory of power plants in the United States 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jul 1984. 84p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84014811.

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Inventory of Power Plants in the United States presents information about electric generating units operated by or planned to be operated by electric utilities in the United States (the 50 States and the District of Columbia). The summarized data contained in this report are useful to a wide audience including Congress, federal and state agencies, the electric utility industry, and the general public.

37788 **(DOE/EIA—0226(84/04)) Electric Power Monthly, April 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jul 1984. 45p. NTIS, PC A03/MF A01 - GPO; GPO Dep. Order Number DE84014370.

The Electric Power Monthly (EPM) includes comprehensive information about the electric utility industry in the United States. Detailed, plant-level data are contained in the Electric Power Quarterly. The summarized data contained in this report are presented for the use of a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public.

37789 **(DOE/EIA—0397(84/1Q)) Electric power quarterly, January-March 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jul 1984. 323p. NTIS, PC A15/MF A01; 1 - GPO; GPO Dep. Order Number DE84014933.

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The Electric Power Quarterly (EPQ) provides electric utilities' plant-level information about the cost, quantity, and quality of fossil fuel receipts, net generation, fuel consumption, and fuel stocks. The EPQ contains monthly data and quarterly totals for the reporting quarter. These data are published to provide meaningful, timely, objective, and accurate energy information for a wide audience including Congress, Federal and State agencies, industry, and the general public.

37790 **(DOE/EIA—0451) Coal-fired capacity additions system: evaluation and testing.** Lawrence, M.S.S.; Smith, S.R. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jul 1984. 100p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84015023.

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This report provides the results of testing the Coal-Fired Capacity Additions System (CCAS), which is used to estimate future coal-fired steam generating capacity additions at the national level using historical data on construction milestones. Using the CCAS, yearly capacity additions were estimated for the period from 1971 through 1982 and compared with the capacity actually added. The 1975-82 CCAS estimates were also compared with published industry estimates. The report provides estimates, based on this methodology, of future coal-fired capacity additions. 1 figure, 21 tables.

37791 **(DOE/ET/29136—1) Effectiveness analysis of electric energy systems.** (California Univ., Berkeley (USA)). Apr 1982. Contract AS01-77ET29136. 344p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84013606.

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This document is the final report of the research project on Effectiveness Analysis of Electric Energy Systems sponsored by the Division of Electric Energy Systems of the Department of Energy. This final report consists of a collection of fourteen papers that are the research results of the project. These papers are either published or submitted for publication. Our efforts have been concentrated on one major aspect of effectiveness analysis, namely, the reliability analysis. The primary objective of our research is to develop methodologies for reliability evaluation of power systems taking into account the structure of the systems (i.e., network interconnections). A hierarchy of power system models that vary both in scope of representation and level of abstraction are considered.

37792 **(EPRI-AP—2739-Vol.2) Combustion-turbine design guidelines based on deposition-corrosion considerations. Volume 2. Coal-derived liquid studies. Final report.** Mulik, P.R.; Lee, S.Y.; Wenglarz, R.A.; Spengler, C.J.; Whitlow, G.A.; Lew, H.G. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Jun 1984. 206p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920498.

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A program has been completed to assess deposition and corrosion effects in combustion turbines that may use coal-derived liquid (CDL) fuels. A total of six tests were completed, involving over 1400 h of test operations in a turbine simulator (pressurized-test passage). The first four tests used a blended fuel from the SRC II process that contained about one-fourth heavy distillate with the middle distillate to accelerate possible corrosion and deposition effects. The fifth test used only the SRC II middle distillate fraction. In the sixth and final test, a 50/50 wt % mixture of the SRC II blend and two-stage liquefaction (TSL) solids from the SRC I process was evaluated.

37793 **(EPRI-AP—3551) Capacity factors and costs of electricity for conventional coal and gasification-combined-cycle power plants. Final report.** Zaininger, H.W.; Bell, D.J. (Zaininger Engineering Co., San Jose, CA (USA)). Jun 1984. 139p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920479.

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It is common practice to compare alternative power plants such as conventional coal and gasification-combined cycle (GCC) plants using bus bar costing methodology. (The levelized bus bar revenue requirements of a single unit are calculated by multiplying plant investment by a levelized fixed charge rate, adding levelized fuel, operating, and maintenance costs, then dividing the total by

annual production at an arbitrarily selected annual capacity factor.) The purpose of this study was to perform thirty-year generation system assessment on the EPRI West Central Regional System from 1991-2020, comparing alternative conventional coal and GCC expansion plans for a range of study assumptions and criteria. These system assessments consist of determining optimal generation expansion plans and associated fixed charges for conventional coal and GCC plants, calculating system production costs using economic system dispatch procedures for each of the thirty years, and determining annual energy production and capacity factors for the conventional coal and GCC additions, as well as the rest of the system generation. These total system results over the thirty-year period are then used to determine relative levelized mills per kWh energy production and capacity factors, and are compared with the results obtained from a conventional bus bar costing analysis. The results of this system study show a significantly better mills per kWh advantage for GCC units compared to conventional coal units than indicated by a conventional bus bar costing assessment. Thus, it is essential to perform a system analysis to properly evaluate the merits of alternative generation technologies such as GCC and conventional coal plants.

37794 **(EPRI-EA—3255) Load data transferability. Final report.** Linder, K.P.; Breese, J.S. (ICF, Inc., Washington, DC (USA)). Jul 1984. 145p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920448.

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Load data transfer is a procedure whereby electric utility load data are modified to reflect conditions other than those under which the data were collected. The modified, or transferred, data can substitute for metered load data, potentially reducing the costs of data development in support of utility planning and regulatory activities. This report defines an analytic framework for transferring utility load data and represents an initial effort in applying the framework in transferring residential loads. The report identifies and evaluates alternative approaches to load data transfer. Three structural techniques--identified as the buildup, adjustment, and hybrid techniques--are developed and applied in selected demonstration projects using actual utility load research data and service area characteristics. The report concludes that effective load data transfer is feasible. Because the project represents an initial effort in a new area of research, the report focuses attention on data availability and analytic issues that limit the development of specific transfer methods and their application. Recommendations for next steps and further analysis are presented.

37795 **(EPRI-EA—3560-CCM-Vol.2) Residential response to time-of-use rates. Volume 2: user's guide to RETOU.** Caves, D.W.; Christensen, L.R.; Herriges, J.A. (Christensen (Laurits R.) Associates, Inc., Madison, WI (USA)). Jun 1984. 44p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920455.

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Goal of the transferability project was to develop a model to simulate changes in residential customer loads in response to mandatory residential Time-of-Use (TOU) pricing of electricity. Estimation of the model was based upon data for individual households participating in residential pricing experiments in selected areas throughout the United States. There was considerable variation among the experiments in climate, and among sampled customers in appliance holdings, income, housing characteristics, and climate. During the first phase of the project, the residential pricing experiments were appraised in terms of their potential to contribute to the development of the transferability model. Five experiments were selected as the basic data base for the transferability model: Carolina Power and Light, Connecticut Light and Power, Los Angeles Department of Water and Power, Southern California Edison, and Wisconsin Public Service Corporation. Statistical analysis was used to estimate economic models of residential response to TOU rates for the individual experiments, and to test whether customer response was consistent across the experiments once the effects of appliance holdings, customer characteristics, and climate had been accounted for. This volume relates to RETOU, a computer code for simulating residential response to TOU rates.

37796 **(EPRI-EA—3560-Vol.1) Residential response to time-of-use rates. Final report. Volume 1: development and demonstration of a transferability model.** Caves, D.W.; Christensen, L.R.; Herriges, J.A. (Christensen (Laurits R.) Associates, Inc., Madison, WI (USA)). Jun 1984. 171p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920456.

Goal of the transferability project was to develop a model that utilities could use to simulate changes in residential customer loads in response to mandatory residential Time-of-Use (TOU) pricing of electricity. Estimation of the model was based upon data for individual households participating in residential pricing experiments in selected areas throughout the United States. This volume relates to the development, implementation, and application of the transferability model to Duke Power Co.

37797 **(EPRI-EA—3560-Vol.3) Residential response to time-of-use rates. Final report. Volume 3: data and statistical appendixes.** Caves, D.W.; Christensen, L.R.; Herriges, J.A. (Christensen (Laurits R.) Associates, Inc., Madison, WI (USA)). Jun 1984. 276p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920426.

The goal of the transferability project was to develop a model that utilities could use to simulate changes in residential customer loads in response to mandatory residential Time-of-Use (TOU) pricing electricity. Estimation of the model was based upon data for individual households participating in residential pricing experiments in selected areas throughout the United States. There was considerable variation among the experiments in climate, and among sampled customers in appliance holdings, income, housing characteristics, and climate. During the first phase of the project, the residential pricing experiments were appraised in terms of their potential to contribute to the developmemt of the transferability model. On the basis of this appraisal, five experiments were selected as the basic data base for the transferability model: Carolina Power and Light, Connecticut Light and Power, Los Angeles Department of Water and Power, Los Angeles Department of Water and Power, Southern California Edison, and Wisconsin Public Service Corporation. Statistical analysis was used to estimate economic models of residential response to TOU rates for the individual experiments, and to test whether customer response was consistent across the experiments once the effects of appliance, holdings, customer characteristics, and climate had been accounted for. Results showed that consistency did exist; it is possible to use a single model to simulate customer response for a wide range of service territories in the United States. The primary factor that determines the degree of customer response is the price differential between peak and off-peak usage. The degree of customer response is also related to appliance holdings, customer characteristics, and climate.

37798 **(EPRI-EA—3575) Study of effect of load management on generating-system reliability. Final report.** Patton, A.D.; Singh, C. (Associated Power Analysts, Inc., Bryan, TX (USA)). Jul 1984. 46p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920462.

This report describes the effects that load shape changes caused by load management will have on selected reliability indexes - expected number of hours of generating capacity deficiency, expected unserved energy, frequency of capacity deficiency events, and the expected duration of capacity deficiencies. Results calculated with the new OPCON model are compared with results from two other, more conventional models that are in use for determining reliability. The models were run with five load management scenarios controlling water heaters and air conditioners, for two annual load shapes with winter and summer peaks, and for EPRI's synthetic utility.

37799 **(EPRI-EA—3576) Examination of methods for providing residential customers with estimates of end-use electricity consumption. Final report.** McCarthy, P.M.; Barnes, H.H.; Harris, L.R. (Applied Management Sciences, Inc., Silver Spring, MD (USA)). Jun 1984. 153p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920492.

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During a time of rising energy prices, end-use information is believed to help residential customers better understand the value of electricity and the purchase choice they exercise in using the various services it provides. This study explores existing methods of providing end-use information to residential customers for marketing and customer-relations purposes, assesses these methods in terms of their ability to provide accurate, timely end-use information for customers, potentially including display on customer's bills, and makes recommendations that will improve the electric utility industry's ability to employ end-use information for residential marketing and customer-relations purposes. Eighteen utilities provided input to the study. Their experience indicates that there are two basic methods presently in use for developing end-use information for residential customers. The first of these uses statistical estimation techniques based on national, regional, local, or customer-specific data. The second uses metering techniques. Statistical estimation techniques were reported most often. None of the reporting utilities display end-use information on customer bills or update it on a periodic basis. Major concerns regarding updating and display involve the accuracy of the information and the cost of developing it. To assess the need for further research on end-use information systems, model profiles of estimation and metering programs were established and compared with the existing programs. Research needs were identified from this comparison.

37800 **(EPRI-EA—3609) Design of alternative rates for public power systems: issues and procedures. Final report.** Dickson, C.; Chamberlin, J. (ICF, Inc., Washington, DC (USA)). Jul 1984. 237p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920488.

This report is intended as a guidebook that would be useful for costing and rate design purposes, particularly for smaller electric systems. It describes techniques for calculating time-varying costs and for employing these costs in the development of rate structures and special incentive rates. Emphasis is placed on costing procedures and rate design analysis methods that are useful to distribution utilities, including those whose generation capacity is not substantial.

37801 **(NP—4770427) Research on parameters influencing the required reserve capacity for the day-to-day power plant operational planning.** Garces, F. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 5 Feb 1982. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770427.

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Reliability is a dominant factor in electric energy supply. The basis requirement for reliable supply is careful day-to-day power plant operational planning for the load distributor, the determination of those power station blocks requiring maintenance or which are involved in failures and which are relevant for the required capacity reserves being a central issue. The paper on hand analyses the parameters influencing the capacity reserves and compares the consequences for the results by means of calculations of several realistic power plant systems in the Federal Republic of Germany. Requirements for the design of power plant systems and the required data base for back-up calculations are derived therefrom.

37802 **(SAND—84-0241) Review and evaluation of literature on coal and nuclear fuel cycle risk comparisons.** Finley, N.C.; Clark, N.H. (Sandia National Labs., Albuquerque, NM (USA)). May 1984. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015124.

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Many of the inadequacies in existing analyses could be removed if there were better data and analysis of that data in the area of health effects of the coal fuel cycle. Data needed include dose/response functions for the various routine emissions from coal plants, as well as some means for quantitatively separating out the effects of these emissions from normal pollution. A common problem in the existing comparisons between the coal and nuclear fuel cycles is that of which metric should be used for comparison. Gaseous emissions from the coal cycle would be better represented by one metric (e.g., additional lung disease) while the normal radioactive effluents from nuclear plants would be better described by another (e.g., additional cancers). Existing models for calculating potential health effects from the coal fuel cycle are quite simplistic. On the other hand, somewhat more sophisticated models exist for calculating potential effects from various aspects of the nuclear fuel cycle. Additional work is needed to improve the state-of-the-art in coal fuel cycle models so that more credible comparisons can be made. The question of credibility/acceptability remains and will have to be addressed in any further work in this area. Other areas for additional work include the problems of economic analysis and socioeconomic and sociopolitical impacts assessment.

37803 **(TVA/OGM/IO—84/2) Annual report of the Tennessee Valley Authority for the fiscal year ending September 30, 1983. Volume II. Appendixes.** (Tennessee Valley Authority, Knoxville (USA)). 1983. 135p. NTIS, PC A07/MF A01. Order Number DE84901360.

This is the Tennessee Valley Authority's 1983 annual report (Volume II). Contained within this report are appendixes including the financial statements, power contracts and a summary of litigation. Also contained within an appendix are statistical tables on fertilizer distribution, material distribution, power sales and TVA procurement sources.

37804 **Modeling demand and supply interactions to forecast load growth for electricity distribution systems.** Maddigan, R.J.; Rizy, C.G. (Oak Ridge National Laboratory, Oak Ridge, TN). *Energy (Oxford);* 9: No. 2, 149-162(Feb 1984).

Distribution systems such as the Rural Electric Cooperatives (RECs) in the U.S. obtain power largely through purchases. Supply is often guaranteed through long-term contacts, and prices may be less sensitive in the short run to increases in fuel costs. The development of a model to capture some of the unique features of the RECs cost structures is discussed. The use of such a model in forecasting the growth of the cooperatives is presented; three scenarios of alternative assumptions regarding the growth of fuel prices are analyzed. Based on these scenarios, it is concluded that the annual load growths of RECs will range between 3.6 and 5.9% to the year 2000.

37805 **Contractual arrangements with the Tennessee Valley Authority for the Purchase of electric power. Hearing before the Subcommittee on Regional and community Development, United States Senate, Ninety-Eighth Congress, First Session, November 14, 1983.** Washington, DC; Government Printing Office (1984). 142p.

Joe LaGrone, Manager of DOE's Oak Ridge Operations Office, and Hugh G. Parris of the Tennessee Valley Authority's Office of Power, were the principal witnesses at a hearing on DOE obligations to purchase $1.25 billion worth of surplus Tennessee Valley Authority (TVA) power that DOE does not need. A representative of the Alabama Municipal Electric Authority, which may want to buy the power, also testified. TVA's excess power is the result of optimistic projections for the demand of enriched uranium which did not materialize and the loss of major markets to foreign competitors. Speaking for the Alabama-Mississippi municipals, Robert Thorington criticized DOE and TVA for not resolving legal impediments to allow the sale of contracted power. Responses to written questions follow the testimony of each of the three witnesses.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 29800037182, 37750, 37777, 37778, 37779

37806 **(DOE/BP—233) Documentation of the Pacific Northwest nonresidential buildings feasibility survey. Volume I. General building and thermal shell characteristics.** Cameron, L.A.; Windell, P.A. (USDOE Bonneville Power Administration, Portland, OR). 1984. 186p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84013726.

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This report focuses on the survey findings rather than methodology. A summary of the findings is presented in textual form, with detailed statistical findings in tabular form. This report adds significantly to the volume of information on the composition of Pacific Northwest commercial buildings and their energy use. It may also serve to illuminate strengths and weaknesses of the methodologies of the Westat study. These insights should prove valuable in designing future commercial surveys, and in designing energy conservation programs for commercial buildings. 106 tables.

37807 **(DOE/BP—234) Documentation of the Pacific Northwest nonresidential buildings feasibility survey. Volume II. Equipment characteristics.** Cameron, L.A. (USDOE Bonneville Power Administration, Portland, OR). 1984. 246p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84014171.

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This report focuses on the survey findings rather than methodology. This report presents a summary of the findings in textural form. In addition, it presents detailed statistical findings in tabular form. This report adds significantly to the volume of information on the composition of Pacific Northwest commercial buildings and their energy use. It may also serve to illuminate strengths and weaknesses of the methodologies of the Westat study. These insights should prove valuable in designing future commercial surveys, and in designing energy conservation programs for commercial buildings. 214 tables.

37808 **(DOE/BP—235) Documentation of the Pacific Northwest Nonresidential Buildings Feasibility Survey. Volume 3. Annual energy consumption.** Cameron, L.A. (USDOE Bonneville Power Administration, Portland, OR). 1984. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84014124.

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This report focuses on the survey findings rather than methodology. This report presents a summary of the findings in textual form, and detailed statistical findings in tabular form. This report adds significantly to the volume of information on the composition of Pacific Northwest commercial buildings and their energy use. It may also serve to illuminate strengths and weaknesses of the methodologies of the Westat study. These insights should prove valuable in designing future commercial surveys, and in designing energy conservation programs for commercial buildings. 119 tables.

37809 **(DOE/EIA—0314(82)) Residential Energy Consumption Survey: housing characteristics, 1982.** Thompson, W. (USDOE Energy Information Administration, Washington, DC. Energy End Use Div.). Aug 1984. 228p. NTIS, PC A11/MF A01; 1 - GPO; GPO Dep. Order Number DE84015224.

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Data in this report cover fuels and their use in the home, appliances, square footage of floor space, heating equipment, thermal characteristics of the housing unit, conservation activities, wood consumption, indoor temperatures, and weather. The 1982 survey included a number of questions on the reasons households make energy conservation improvements to their homes. Results of these questions are presented. Discussion also highlights data pertaining to: trends in home heating fuels, trends in conservation improvements, and characteristics of households whose energy costs are included in their rent.

37810 **(DOE/MC/19285—1505-Vol.2-App.) Analysis of potential combustion source impacts on acid deposition using an independently derived inventory. Volume II, appendices.** (PEDCo-Environmental, Inc., Cincinnati, OH (USA); Spaite (Paul W.) Co., Cincinnati, OH (USA)). Dec 1983. Contract AC21-82MC19285. 336p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE84012006.

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This document contains 2 appendices. The first documents the methodologies used to calculate production, unit energy consumption, fuel type and emission estimates for 16 industries and 35 types of facilities utilizing direct-fired industrial combustion processes, located in 26 states (and the District of Columbia) east of the Mississippi River. As discussed in the text of this report, a U.S. total of 16 industries and 45 types of facilities utilizing direct-fired combustion processes were identified by an elimination type method that was developed based on evaluation of fuel use in industrial SIC codes 20-39 to identify pollutant sources contributing to acid rain. The final population included only plants that have direct-fired fuel consumption greater than or equal to 100 x 10^9 Btu/yr of equivalent energy consumption. The goal for this analysis was to provide at least a 1980 base year for the data. This was achieved for all of the industries and in fact, 1981 data were used for a number of the industries evaluated. The second contains an analysis of all consumption of major fossil fuels to: (1) identify all fuel usage categories, and (2) identify the kinds of combustion equipment used within each category. This analysis provides a frame of reference for the balance of the study and permits using an energy accounting methodology to quantify the degree to which the inventoried sources in individual consuming sectors are complete and representative of the total population for the sector.

37811 **(LA—9445-PNTX-K) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: predictions of energy requirements.** Schnurr, N.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008070.

This report documents work perfomed in support of the preparaion of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. Energy requirements for each of the alternatives addressed in the EIS are discussed in this report. The present consumption of natural gas and electricity at the Pantex Plant is analyzed, and methods of reducing energy use are investigated. Predictions of energy requirements for all alternatives are developed.

37812 **(LA—10099-MS) Nuclear rate increase study.** Drake, R.; Youngblood, A.; Williams, D. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013864.

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This report estimates first-year electricity rate increases that will be necessary for the 51 new nuclear plants which 31 utilities now have under construction. Two methods of estimating electricity price increases resulting from new coal plants are also presented, and the resulting increases are compared with those for nuclear plants. Data indicate that rate increases are not always higher for nuclear plants than for coal plants, implying that rate shock is not solely the result of technological choice. Under pessimistic assumptions, the median utility rate increase resulting from new nuclear plants is 23%, but if utility sales should rise to absorb all of the new nuclear plant output, the rate increase would fall to about 10.5%. 10 references, 7 tables.

37813 **(PB—84-185842) Large-scale electricity-production scheduling via non-linear optimization.** van de Bosch, P.P.J.; Lootsma, F.A. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1984. 17p. (R—84-07). NTIS, PC E03/MF E01.

In this paper the authors propose fast methods for solving non-linear optimization problems which occur in the daily scheduling of electricity production: problems with a non-linear cost function, lower and upper bounds on the variables, and an equality constraint. If the cost function is quadratic, the authors use a modified Lagrange-multiplier technique; for a non-quadratic cost function they employ conjugate search directions and a projection method. Numerical examples demonstrate the effectiveness of the approach - exploitation of a special structure - for problems with hundreds of variables.

37814 **Energy utilization comparisons on a national basis.** Fricke, H.J. pp 429-435 of Advances in energy costs savings for industry and buildings. Atlanta, GA; Fairmont Press (1983). (CONF-831115—).

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

As energy costs are becoming more significant, the development of a computer energy consumption report for comparison purposes is now a necessity. This paper studies a back-to-basics report developed for the Bell & Howell Lincolnwood North Facility which includes monthly and annual BTU's used for individual as well as combined electric and fuel use. The report concludes with a summation of projects which should be continued prior to committment of any long range large expenditures. Energy use curves, percent of change, description of facilities, rent costs determination, and reporting the progress is included.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 29900037398, 37451, 37486, 37492, 37493, 37496, 37765, 37783

37815 **(DOE/IR/10283—T3) Legislator's guide to renewable energy: draft text. Final report, Vol. III.** (National Conference of State Legislatures, Denver, CO (USA)). Aug 1981. Contract FG01-79IR10283. 210p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84013301.

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Information about advantages and disadvantages of renewable energy are considered in the context of other forms of energy considering the government's both public and private sectors. State and regional resource variables are factored. Individual energy sources, direct state action, financial incentives, electric utilities role for municipalities, consumer protection, and information dissemination are the broad issues approached. (PSB)

37816 **(Juel-Spez—233) Part played by forests in the energy supply of developing countries.** Kleemann, M.; Kobo, S.; Meliss, M. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung). Dec 1983. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751939.

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The part played by forests and wood in the energy supply and resulting effects on environment have become quite topical for discussion, particularly in these days. It is in the developing countries with their dependence on wood of up to 90%, that the energy crises makes itself felt as a fuel-wood crises espec. in the rural areas. This is linked with inconsiderate felling of forest reserves which, above all, entails serious ecological problems. The following three contributions which can be seen as individual papers complete in themselves, are an attempt at giving a present-state summary of knowledge acquired with today's types of and effects through forest utilization. They intend to indicate the degree of importance of forests for the energy supply and the environment in developing countries, thus, providing the basis of an argumentation for an enhanced attention to be given to this problem in energy planning in the countries concerned.

30 DIRECT ENERGY CONVERSION

REFER ALSO TO CITATION(S) 30000039096

3001 Mhd Generators

REFER ALSO TO CITATION(S) 30010037164

37817 **(DOE/ET/10815—92) University of Tennessee Space Institute. Quarterly technical progress report, April-June 1983.** (Tennessee Univ., Tullahoma (USA). Space Inst.). May 1984. Contract AC02-79ET10815. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014326.

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The major activities discussed in this quarterly report are concerned with the initiation of testing in the DOE Coal Fired Flow Facility in the LMF1D test series. This test series is designed to provide basic data on seed/slag interaction as a function of diffuser exit temperature and slag carryover rate for the coal fired MHD system with slag screen installed. During the quarter two shakedown tests and three tests in the test series were conducted. Data is reported on the flow train performance, including the combustor, the slag screen, radiant furnace and the materials test module. Analysis of data from the LMF1C test series continues and a summary of the NO/sub x/ data analysis is provided. A summary of the results of application of advanced diagnostic equipment provided by UTSI, Mississippi State University and the Babcock and Wilcox Company is included. In Task 2 the arrival on site of the low temperature air heater is reported. A progress report on the procurement, engineering and installation of the superheater components is included.

37818 **Analysis and measurement of property disturbances in a combustion magnetohydrodynamic plasma.** Simons, T.D.; Mitchner, M.; Eustis, R.H. (High Temperature Gasdynamics Laboratory Stanford University, Stanford, California 94305). *Physics of Fluids;* 27: No. 7, 1880-1886(Jul 1984). Contract AC01-76ET10780.

Measurements of propagating pressure and temperature (entropy) waves in a combustion magnetohydrodynamic (MHD) generator are presented along with a general model which describes how to produce controlled rapid property disturbances in a combustion MHD plasma. The model identifies the principal mechanisms of wave formation and predicts the qualitative and quantitative wave shapes as a function of average plasma and electrical properties but does not describe wave amplification. The model exhibits quantitatively the coupling between the entropy and acoustic waves and the electric current and magnetic field under conditions applicable to MHD power generation.

37819 **Interelectrode resistance and performance of small- and large-scale MHD generators.** Doss, E.D.; Picoliou, B.F. (Argonne National Laboratory, Argonne, IL). *Journal of Energy;* 7: No. 6, 454-855(Nov 1983).

The effect of reduced interelectrode resistance in MHD generators on the generator power output is investigated. The power output, expressed as a fraction of the power output of a perfectly insulated generator, is found to be a function of the wall temperature, the ratio of boundary-layer thickness to channel transverse dimension, and the ratio of interelectrode resistance to average plasma resistance. It is also found that deterioration of performance of MHD generators, resulting from reduced interelectrode resistance, diminishes with generator size and is negligible for large-scale generators, provided that the interelectrode resistance remains larger than an order of 0.1Ω.

37820 **Simplified three-dimensional modeling for MHD DCW channels.** Liu, B.L.; Lineberry, J.T.; Schmidt, H.J. (University of Tennessee Space Institute, Tullahoma, Tennessee). *Journal of Energy;* 7: No. 6, 456-457(Nov 1983).

A three-dimensional, numerical technique for modeling diagonal conducting wall (DCW) magnetohydrodynamic (MHD) generators is developed and discussed. Cross-plane gasdynamic and electrodynamic profiles are computed considerir g coupled MHD flow field and electrical phenomena. A turbulent transport model based on the mixing length theory is used to deal with wall roughness generated turbulence effects. Both sidewall and electrode wall boundary losses are treated. The infinitely fine electrode segmentation formulation is applied to simplify the governing electrodynamic equations. Calculations show the development of distorted temperature and velocity profiles under influences of magnetohydrodynamic interaction. The results furnish a realistic representation of MHD generator behavior.

37821 **Power takeoff analysis and comparison with experiments in a coal-fired MHD generator.** Ishikawa, M.; Scott, M.H.; Wu, Y.C.L. (University of Tennessee Space Institute, Tullahoma, Tennessee). *Journal of Energy;* 7: No. 5, 396-402(Sep 1983).

The power takeoff region of a diagonal conducting wall generator is examined using a twodimensional electrodynamic analysis including the axial gradient of the magnetic induction. Good agreement between this analysis and experimental data was found with respect to both voltage and current distributions. A similar comparison using one-dimensional theory was not satisfactory in the end region. The present analysis correctly predicts the large current observed experimentally at the innermost power takeoff electrode (closest to the main load) under off-design current conditions. In this case an unusual current distribution is also calculated. When a parallel ballast resistor scheme was used for power takeoff it was found that the innermost resistors can play a significant role in reducing the overcurrent that occurs at off-design conditions. It is also shown that a current distribution with tapered ends offers advantages over drawing the same current from each electrode when operation is at off-design current levels. The effect of interframe voltage nonuniformities on power takeoff is also investigated.

37822 **Polarization and sidewall effects in a coal-fired MHD channel.** Ishikawa, M.; Scott, M.H.; Wu, Y.C.L. (The University of Tennessee Space Institute, Tullahoma, TN). *Journal of Energy;* 7: No. 3, 204-210(May 1983). Contract AC02-79ET10815.

The effects of slag polarization on electrodes and several sidewall configurations on generator performance are investigated. An analysis of the experimental voltage/current characteristics between two generator frames is presented along with the examination of nonuniformities of interframe voltage. Experimental data reveal that the polarization effect reduces the overall electrical performance of a 60 deg diagonal conducting wall (DCW) channel by about 3%. Analytically, the effect of polarization on the local current and potential distributions is examined by solving the three-dimensional electrical potential using a finite-element method. A moderate increase of conductivity in the vicinity near the cathode side of the frame gives a calculated leakage resistance which approximates the value derived experimentally. The polarization effect results in a large change of the potential and current distributions near the frame but has a small effect on the overall electrical performance. Alternate sidewall/electrode configurations are considered analytically. First, the sidewall is completely insulated. While leakage is reduced, the performance of the generator is significantly lower due to an increase in the voltage drop. Second, a proportion of the sidewall is made conducting. That is, the electrode surface is extended onto the sidewall. This improves performance. Finally, segmented conducting sidewalls are considered with the result showing performance as expected in a DCW generator with no polarization considered.

37823 **Arc damage of interelectrode insulators in MHD generators.** Unkel, W.; Blackman, L.D. (Massachusetts Institute of Technology, Cambridge, Massachusetts). *Journal of Energy;* 7: No. 3, 272-279(May 1983). Contract AC01-79ET15518.

The damage to interelectrode insulators on the anode wall of an MHD generator, resulting from magnetically driven arcs, has been studied experimentally and analytically. Recession rates of about 1-3 mm/s and damage widths of about 2-4 mm were measured for alumina, boron-nitride, and magnesia insulators at arc currents ranging from 7 to 83 A and at magnetic fields up to 1 T. The recession rate and damage width were affected by both the magnetic body force (IB) and the power dissipated in the arc. In general, boron-nitride performed best and alumina worst. A simple model of the steady arc and the heat transfer from the insulator predicted the damage parameters within a factor of 2. Damage from unsteady arcing can also occur and has not been addressed in detail. The relationship of the fault arc voltage-current characteristics to the width and spacing of electrode sections required for an MHD generator is presented.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 30030037392, 37393, 37394

3005 Fuel Cells

37824 **(ANL—84-9) Advanced fuel cell development. Progress report, July-September 1983.** (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014847.

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This report describes fuel cell research and development activities at Argonne National Laboratory (ANL) during the period July through September 1983. These efforts have been directed principally toward seeking alternative cathode materials to NiO for molten carbonate fuel cells. An investigation was made of the thermodynamically stable phases formed under cathode conditions with a number of transition metal oxides. Prospective alternative cathode materials are being synthesized and doped to promote electronic conductivity. Three materials--$LiFeO_2$, Li_2MnO_3, and ZnO--have been doped to give suitable conductivity. These materials are being further tested for solubility and ion migration in the cell environment. Techniques are being studied for the preparation of thin electrode and electrolyte materials by tape casting, and a creep-resistant superstructure for the anode is under development.

37825 **(DOE/FE/60338—9) Phosphoric and electric utility fuel cell technology development. Technical progress report No. 9.** Breault, R.D.; Briggs, T.A.; Congdon, J.V.; DeMarche, T.E.; Gelting, R.L.; Goller, G.J.; Luoma, W.L.; McCloskey, M.W.; Mientek, A.P.; O'Brien, J.J. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Jan 1984. Contract AC21-83FE60338. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015307.

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The Department of Energy has initiated this program to advance electric utility cell stack technology and to reduce cell stack cost. The cell stack has a nominal 10-ft^2 active area and operates at 120 psia/405°F. The program comprises six parallel phases, which culminate in a full-height, 10-ft^2 stack verification test: Phase I provides the information and services needed to manage the effort, including definition of the prototype commercial power plant; Phase II develops the technical base for long-term improvements to the cell stack; Phase III develops materials and processing techniques for cell stack components incorporating the best available technology; Phase IV provides the design of hardware and conceptual processing layouts, and updates the power plant definition of Phase I to reflect the results of Phases II and III; Phase V manufactures the hardware to verify the achievements of Phases II and III, and analyzes the cost of this hardware; and Phase VI tests the cell stacks assembled from the hardware of Phase V to assess the state of development.

37826 **(DOE/MC/16242—1554) Hot-gas cleanup for molten carbonate fuel cells-dechlorination and soot formation. Final report, May 19, 1981-July 19, 1983.** Ham, D.; Gelb, A.; Lord, G.; Simons, G. (Physical Sciences, Inc., Andover, MA (USA)). Jan 1984. Contract AC21-81MC16242. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84003072.

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Two separate aspects of hot-gas conditioning for molten carbonate fuel cells (MCFC) were investigated under this contract: potential high temperature chloride sorbent materials were sreened and tested and carbon deposition on MCFC components was studied experimentally to determine guidelines for maximizing MCFC efficiency while avoiding carbon fouling. Natural minerals containing sodium carbonate were identified as the most promising candidates for economical removal of chlorides from coal gasifier effluents at temperatures of about 800 K (980°F). The mineral Shor-

tite was tested in a fixed bed and found to perform remarkably well with no calcination. Using Shortite we were able to achieve the program goal of less than 1 ppmV chlorides at 800 K. Shortite is an abundant mineral with no competing commercial demand, so it should provide an economical chloride cleanup sorbent. Measurements showed that carbon deposition can occur in the equilibrium carbon freee region because of the relative rates of the relevant reactions. On all surfaces tested, the Boudouard carbon formation reaction is much faster than the water-gas shift reaction which is much faster than the methanation reaction. This means that the normal practice of adding steam to prevent carbon formation will only succeed if flows are slow enough for the water shift reaction to go substantially to completion. More direct suppression of carbon formation can be achieved by CO_2 addition through anode recycle to force the Boudouard reaction backward. Addition of steam or CO_2 must be minimized to attain the highest possible MCFC efficiency. 28 references, 31 figures, 22 tables.

37827 **(DOE/MC/20212—1629) Effects of H_2S on molten carbonate fuel cells. Progress report, January 1-March 31, 1984.** Remick, R.J. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1984. Contract AC21-83MC20212. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015166.

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The overall program objective is to identify the poisoning mechanism(s) responsible for performance losses of molten carbonate fuel cells (MCFC) when operating on sulfur-containing gases. This objective is being addressed by focusing out-of-cell and in-cell experiments on single mechanistic issues, followed by incorporation of the results into a model that correlates cell potential decline to contaminant(s) concentration. When coupled with gas cleanup cost projectons, the model can be used to conduct trade-off studies leading to the selection of optimum feed-gas compositions for MCFC power plants. The importance of this program is that the degree to which H_2S and other contaminants must be removed from typical MCFC fuels can have a profound effect on the cost of cleaning the fuel gas, especially if contaminant levels lower than 0.1 ppM are required. The anticipated product from the overall program is a justifiable specification for gas cleanup requirements for MCFC power plants. Progress is reported. (WHK)

37828 **(DOE/NASA—0205-8) Full scale phosphoric acid fuel cell stack technology development. Final technical report.** Christner, L.; Farooque, M. (Energy Research Corp., Danbury, CT (USA)). Mar 1984. Contract AI21-80ET17088. 106p. (NASA-CR—174660). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015759.

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Initial emphasis was placed on an atmospheric pressure operation, but later emphasis was shifted to a pressurized operation. Bipolar plate samples were fabricated with different resin contents and samples were heat treated at various temperatures between 900 and 2700°C to improve their corrosion resistance. Physical properties of these plates were characterized and their corrosion behavior was investigated at atmospheric as well as elevated pressure. This effort has provided a strong data base for optimization of bipolar plates. Different carbon support materials and heat treatments were investigated to impart improved cathode stability for pressurized operation. Initial performance improvements of 25 to 40 mV were obtained by the addition of V, Ta or Cr to the standard platinum-on-carbon cathode. Stability of these alloy catalysts, however, needs to be improved. Short stacks assembled with heat-treated plates were operated for up to 22,000 hours.

3008 Miscellaneous Converters

37829 **Numerical analysis of thermomagnetic generators.** Kirol, L.D.; Mills, J.I. (Special Energy Programs, EG & G Idaho, Inc., Idaho National Engineering Laboratory, Idaho Falls, Idaho 83415). *Journal of Applied Physics;* **56**: No. 3, 824-828(1 Aug 1984). Contract AC07-76ID01570.

Thermomagnetic generators allow direct conversion of heat energy to electrical energy. Temperature cycling about or near the Curie temperature causes changes in magnetization, resulting in time variant magnetic flux and induced voltage in a surrounding conductor. Numerical analyses of regenerative thermomagnetic generators with perfect regeneration have been performed for three working materials: iron, gadolinium, and $Ho_{69}Fe_{31}$. Power density above 20 W/kg of shunt material and efficiency approaching Carnot limits are possible over temperature differences of 50 K. Analytical studies performed during the 1950s predicted maximum power density less than 7 W/kg and efficiency less than 1% for nonregenerative cycles.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 32000037499, 39096

3201 Buildings

REFER ALSO TO CITATION(S) 32010037467, 37809, 37811, 37881, 37894, 38142

37830 **(BMFT-FB-T—84-068) Experimental determination of the properties of working mixtures for absorption heat pumps.** Girgis, M.M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1984. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751932.

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1) State of research: Until recently no working mixture ideally suited for the absorption heat pump process had been found, i.e., which allows for air temperatures as low as -10°C, for technically reliable operation and for a high efficiency. 2) The objectives are: Experimental determination of the phase equilibrium data for the ternary system CH_3OH-LiBr-$ZnBr_2$. Investigation of the thermal stability of this system. 3) Methods: The solubility temperatures of a methanol-salt mixture is measured as the lowest temperature at which all crystals in the cooled mixture are completely dissolved upon reheating. The vapor pressure data are measured using the static method. The occurrence of thermal decomposition of a methanol-salt solution is indicated by an increase in vapor pressure. The determining measurements are to be undertaken in the vapor pressure apparatus. 4) Results: The solubility data for the binary systems CH_3OH-LiBr and CH_3OH-$ZnBr_2$ as well as for the ternary system CH_3OH-LiBr-$ZnBr_2$ with the salt-mole ratios 1, 2, 3 and 4. Vapor pressure measurements for the systems CH_3OH-LiBr, CH_3OH-LiBr-$ZnBr_2$ and CH_3OH-4LiBr-$ZnBr_2$ in the entire solubility range. Decomposition temperatures for some of these systems. 5) Conclusion: In a numerical example, the specific solution flow ratio and the heat ratio were calculated for various reversible absorption heat pump processes, using as working mixtures the systems under consideration as well as the NH_3-H_2O system. Because of the thermal decomposition of methanol, the highest generator temperature is limited from above, which prevents a practical application of these systems for absorption heat pumps for room heating.

37831 **(DOE/CS/30589—T1) Solar heat gain control in historic buildings rehabilitation alternatives.** (National Park Service, Denver, CO (USA). Div. of Cultural Resources). 1984. Contract AI01-80CS30589. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013614.

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Basic information is presented regarding the importance of existing windows and their glazing to historic buildings, the phenomenon of solar heat gain through windows, the properties of commonly available solar glazing types and sympathetic alternatives to the installation of inappropriate darkly tinted or highly reflective solar glazing in historic buildings. Although the basic principles of solar heat gain through windows is the same for both new construction and existing buildings, the recommendations that are included are specifically targeted toward historic buildings.

37832 **(DOE/R7/01124—T1) Measurements of thermal mass of existing buildings. Final report.** (Southwest Missouri State Univ., Springfield (USA). Dept. of Physics). 1982. Contract FG47-80R701124. 114p. NTIS, PC A06; 3; GPO Dep. Order Number DE84007717.

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An analysis of data taken on a test house at Southwest Missouri State University indicates that it may not be possible to obtain anything more than a rough estimate for the heat capacity of a house. Weatherization and data acquisition are described. (MHR)

37833 **(DOE/R8/00458—T1) Guidelines for energy conservation on our landscapes. Final report.** Wegkamp, L. (Utah State Univ., Logan (USA)). 16 Jun 1982. Contract FG48-79R800458. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015673.

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The development of media materials to demonstrate criteria and guidelines necessary in conserving energy utilizing landscape design and community planning, and the sharing and dissemination of information through a series of eight statewide community education workshops by the Cooperative Extension Service are described.

37834 **(EPRI-EA—3606-Vol.1) Measuring the impact of residential conservation. Volume I. An econometric analysis of national data.** Crow, R.T.; Hausman, J.A.; Lawrence, A.G.; McGillivray, R.G.; Robinson, M.J.; Squitieri, R. (Little (Arthur D.), Inc., San Francisco, CA (USA). Western Div.; Applied Forecasting and Analysis, Inc., Los Altos, CA (USA)). Jul 1984. 203p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920439.

Two national data sets were analyzed to investigate the behavior of residential customers in consuming and conserving electricity. The data sets were the National Interim Energy Consumption Survey (NIECS) and the Annual Housing Survey (AHS). The mode of analysis was econometric modeling. The heart of this report is four empirical studies using the national data sets. These include: (1) a study of end-use consumption, based on NIECS survey data and billing data, by means of conditional demand analysis; (2) two studies of the probability of taking conservation actions - one based on a probit approach using the AHS data, the other based on linear probability and discriminant analysis approaches using the NIECS data; (3) a study of the impact of conservation actions on kWh consumption, using the NIECS data. In addition, the report includes discussion of advantages and dangers of using national analysis for specific utility application and of conceptual and empirical issues of attempting to infer household discount rates from household survey data.

37835 **(EPRI-EM—3582) Heat pump water heaters. Final report.** Dobyns, J.E.; Blatt, M.H. (Science Applications, Inc., La Jolla, CA (USA)). May 1984. 105p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920467.

A survey of the eleven manufacturers of heat pump water heaters (HPWHs) in the United States is presented. Product characteristics and application guidelines, including economic comparisons to other means of water heating, are summarized. A survey of forty-five utilities, identified as having conducted field tests of HPWHs, is also presented. Based on the experiences of these utilities, experimental designs, instrumentation schemes, and data reduction methods are recommended. A brief assessment of utility load profile impacts illustrates that HPWHs can provide peak load reductions compared to electric resistance water heaters. Specific recommendations are made for further research and development of HPWHs.

37836 **(LBL—17429) Measurement of fenestration performance under realistic conditions.** Klems, J.H. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 10p. (CONF-840610—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014610.

From Windows in building design and maintenance conference; Gothenburg, Sweden (13 Jun 1984).

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The need for fenestration performance measurements under realistic conditions is noted, and the Mobile Window Thermal Test facility (MoWiTT), newly constructed at LBL to make these measurements, is described. A key feature of the MoWiTT is the direct measurement of instantaneous net energy flow in the presence of sunlight. Ongoing calibration to establish the accuracy of this facility is described, and calibration data so far obtained are presented. Estimates from these data indicate that the facility will have sufficient accuracy for most fenestration measurements of interest.

37837 **(LBL—17683) Obstacles to the use of exterior fenestration and daylighting control systems in the US.** Sweitzer, G.; Johnson, R. (Lawrence Berkeley Lab., CA (USA)). Mar 1984. Contract AC03-76SF00098. 10p. (CONF-840610—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014591.

From Windows in building design and maintenance conference; Gothenburg, Sweden (13 Jun 1984).

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Exterior fenestration and daylighting control systems can provide excellent control of solar gain and glare and still be visually satisfying elements in the design of building envelopes. However, US building industry experience with exterior fenestration and daylighting control systems suggests that durability and proper function of these systems is often unsatisfactory. Yet in Western Europe, exterior systems are a proven, cost-effective, and aesthetically accepted fenestration design element. It is suggested that these contrasting operating experiences reflect differences in prevailing US/Western European approaches to building design, construction, and operation. Three representative US building case studies are examined, each describing the application of exterior fenestration/daylighting control components previously untested as a system, and some unsatisfactory consequences. Several changes that may assist in increasing the acceptance and success of these systems in the US building industry are suggested.

37838 **(LBL-PUB—473-1) Computerized instrumented residential audit (CIRA).** (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014607.

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CIRA is a user friendly program for making a model of energy usage in a single-zone building, such as a single family dwelling. The program predicts the optimal package of energy-saving improvements to such a building. The program will be of interest mainly to architects, contractors, energy consultants and engineers. CIRA was largely completed in 1983 and had limited distribution (150 copies) through this laboratory using only word-of-mouth advertising. The program has been improved as a result of feedback from early users. LBL will cease distribution when the program is made satisfactorily available through commercial channels.

37839 **(PB—84-167477) BKL-method: a simplified method to predict energy consumption in buildings.** Kaellblad, K.; Adamson, B. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1984. 65p. (D—8:1984). NTIS, PC E04/MF E01.

Today several computer programs, based on detailed models of buildings, are available for calculation of heat consumption. Nevertheless, there is still a need for simplified methods, for example to be used as design tools in the early lay-out of a building when main frame computers are not accessible or when complex programs are too expensive to use. The method described herein was developed to be used as a hand calculation method but the development of personal computers gives the possibility to use the method as a very quick design tool. The method cannot replace complex computer programs and should be seen as an improved degree-day method.

37840 **(PB—84-182005) Development of a high efficiency, gas fired, heat pipe, warm air heating system. Semiannual report Jan-Jun 83.** Feldman, S.; Patch, K.; Becker, F. (Thermo Electron Corp., Waltham, MA (USA)). Jun 1983. 192p. (TE—4296-245-83). NTIS, PC A09/MF A01.

Ten residential heat pipe furnaces were installed at various test homes around the country. Measurements indicated a mean seasonal efficiency for the heat pipe furnace of 83 percent compared with the laboratory determined steady-state efficiency of 85 percent. At those sites where conventional furnaces were used as standards, the heat pipe furnace provided an average savings of 18 percent. A completely integrated warm air heating system was installed in an 11th home. The system used automated registers controlled by individual room thermostats in conjunction with the heat pipe furnace modified to modulate its output depending upon the load. The integrated system demonstrated that improved comfort could be obtained with its use relative to the traditional single-zone control.

37841 **(PB—84-185438) Energy cost of houses and light construction buildings.** Baird, G.; Aun, C.S. (New Zealand Energy Research and Development Committee, Auckland). Nov 1983. 82p. (R—76). NTIS, PC E05/MF E01.

Prepared in cooperation with Victoria Univ., Wellington, New Zealand.

This report describes a preliminary investigation into the energy requirements for house construction in New Zealand. Estimates have been made of the direct energy requirements for house construction, the energy used in the manufacture and transport of construction materials, and the energy embodied in imported materials. A preliminary set of energy coefficients for a range of building materials is put forward, and comparison made with overseas data of this type. The direct and indirect energy involved in constructing a standard New Zealand timber framed house is calculated, and compared with anticipated operating energy requirements. The effect of using alternative building materials is also investigated, together with the energy needed for building maintenance.

37842 **(PB—84-188192) Rehabilitation guidelines 1982. 10: guidelines on the rehabilitation of walls, windows, and roofs.** (National Inst. of Building Sciences, Washington, DC (USA)). Jun 1983. 0123p. NTIS, PC A06/MF A01.

These guidelines describe typical methods and procedures for rehabilitating many common types of walls, windows, and roofs in existing structures. They also present cautions appropriate to each type of material. The guidelines emphasize the retention of esthetic qualities as well as the preservation of structural integrity. A discussion of masonry explains procedures for cleaning, repainting, and the problems of various types of coatings. Guidelines on wood frame exterior walls focus on the rationale for preserving historic character, energy conservation, and the use of alternative materials like aluminum and vinyl siding. Wood windows are discussed from the standpoint of their significance, repairs, weatherization, and replacement. Roofing rehabilitation guidelines cover water protection, energy conservation, and maintenance. Photographs and 20 references are included. Appendices include draft guidelines on rehabilitating historic buildings, a list of sources on preservation, an explanation of techniques for repairing wood windows, and addresses of regional historic preservation offices of the National Park Service.

37843 **(PB—84-188390) Development of a Home Energy Alert (HEAL) system. Final report.** Swider, E.; Mniszewski, K.; Waterman, T. (IIT Research Inst., Chicago, IL (USA)). Jul 1982. 0252p. NTIS, PC A12/MF A01.

This report discusses the engineering analyses and laboratory tests of energy consumption by six major household appliances and presents two Home Energy Alert (HEAL) systems that identify inefficient operations of these appliances and provide diagnostic procedures to help owners or repairmen make required adjustments or replacements. Each HEAL system consists of three major elements: (1) sensors; (2) transmitters which send signals through house wiring to a receiver console, and (3) an annunciator panel with receivers, a microprocessor, AC driver clock, digital display, and control panels. The annunciator should be located in a central area, preferably the kitchen. The report provides data on sensors and measurement locations most advantageous to the HEAL system and sensor costs in terms of a payback period for the following appliances: gas forced - air furnace, water heater, refrigerator/freezer, central air conditioner, clothes washer, and electric clothes dryer. Also presented is a design and cost analysis of a prototype HEAL system. The HEAL program specified that a system should be able to pay for itself within 5 years or less from energy conserved. The report presents two possible configurations; an ideal system which involves using more sensors and diagnostic features and a practical system with fewer devices and features. To reach a large group of energy conscious homeowners, the system must be reliable, simple, easy to install and monitor, and moderately priced at about $200. However, even the practical HEAL system does not fall into this price range. Therefore, the study suggests developing a small instructional kit to show homeowners how to make simple checks of appliance energy use and general operating conditions. References, tables, diagrams, and photographs are supplied.

37844 **(PB—84-188549) Insulating glass field correlation study 1983.** Spetz, J.L. (Sealed Insulating Glass Manufacturers Association, Chicago, IL (USA)). 15 Jul 1983. 0315p. NTIS, PC A14/MF A01.

Prepared in cooperation with Spetz (Jim) Testing Lab., Wickliffe, OH.

The purpose of this study is to correlate the test performance of sealed insulating glass with its performance in use in buildings in the United States. Survey sites are 13 major cities throughout the country, chosen to provide coverage in most of the geographical areas as well as the severe weather areas of the country. Approximately 2,000 units in approximately 150 buildings are being tested each year for 5 years. A running performance of each unit is recorded using Frost Point Measurement as the control for performance. This test measures the amount of moisture between the two panes of sealed glass. The same test methods are used to determine the level of performance in the certification testing. Yearly, the data collected from the field survey is compared to the test level performance of two test methods. When sufficient moisture migrates into the air space between the two panes of glass, a fog or moisture deposit occurs, first on cold days, and later permanently, making vision through windows obscure. The specification requires frost points colder than 200F to pass each class, which is a conservative value. Visual inspection for fogged units is also made in the study. Among the conclusions is that 6 of the 1,994 units with visual failure after an average of 4 to 5 years is considered very good performance for the industry. It is recommended that the study continue for the fifth year. The bulk of the document consists of tabular data.

37845 **(RAND/N—1925-DOE) Appraisal of evaluations of utility-sponsored programs for residential energy conservation.** Pease, S.R. (RAND Corp., Santa Monica, CA (USA)). Nov 1982. Contract AC01-80PE70269. 77p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84014208.

Utility companies must offer each customer individualized advice on available energy improvements, choosing a contractor, and obtaining funds for installing the devices. DOE's actions suggest that future RCS efforts will depend largely on a utility's commitment to energy conservation, rather than on an enforced federal mandate. Eight past evaluations of utility-sponsored energy conservation programs are reviewed and appraised and their results and implications for the future success of a federal or utility-sponsored RCS effort are discussed.

37846 **(TVA/OP/ECR—84/67) Cycle and Save program participant retroactive survey.** Camp, W.A. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Conservation and Rates). 1984. 52p. NTIS, PC A04/MF A01. Order Number DE84901366.

The Cycle and Save Participant Survey was conducted with the objective of determining who has participated in the Cycle and Save program in the past and, with this knowledge, predict who is likely to participate in the program in the immediate future. This analysis was designed to provide demographic data on both past and expected future participants so that the program manager and communication staff can better position advertising and promotional strategies to target markets.

37847 **Residential energy conservation.** Hirst, E.; Goeltz, R. (Energy Division Oak Ridge National Laboratory, Oak Ridge, TN). *ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Journal;* **26**: No. 1, 33-36(Jan 1984). Contract W-7405-ENG-26.

As part of the federal Residential Conservation Service, electric and gas utilities throughout the U.S. are conducting home energy audits. In the 1981/82 program year, more than one million RCS audits were conducted. These audits provide a wealth of data concerning the potential for, and cost-effectiveness of, "conservation energy" in U.S. homes. Unfortunately, little effort has been made to date to examine and analyze these data. The BPA home energy audits provide considerable information on the potential for cost-effective energy savings in existing homes. Use of this data is complicated because audited homes are not representative of homes in the Pacific Northwest. Participation in the BPA program was restricted to singlefamily homes that use electricity as the primary heating fuel; in addition, participant homes were larger than nonparticipant homes, and participants had larger incomes than nonparticipants. These differences complicate generalization of results from these audits to the Pacific Northwest region as a whole. Similar difficulties in generalization are almost certain to occur with RCS audit data from other locations. (Berry et al., 1981). Nevertheless, the detailed information in the audits (on the characteristics of these houses, and on the likely energy savings and capital costs for individual measures) is truly valuable. Because the data are disaggregate (broken down by house and by measure) and computerized, they can be analyzed in many different ways.

37848 **Effectiveness of building energy performance standards to curtail household energy demand: a theoretical analysis.** Mathur, V.K. (Cleveland State Univ., OH). *Energy Journal;* **5**: No. 1, 99-114(Jan 1984).

The main purposes of Titles III and IV of the Energy Conservation and Production Act of 1976 are to curtail energy use in households and commercial buildings. The authors analyze the effectiveness of various policies emerging from these Titles, and compares them with alternate, though traditional, policies of pricing, taxes, and subsidies aimed at reducing energy demand. The study concludes that a pricing policy is more efficient than a direct regulatory policy that requires more bureaucracy. 10 references, 1 figure.

37849 **Low-Income Home Energy Assistance amendments of 1984. Report presented by the Committee on Energy and Commerce, House of Representatives, Ninety-Eighth Congress, Second Session.** Washington, DC; Government Printing Office (1984). 29p.

The Committee on Energy and Commerce recommends an amended H.R. 2439, which changes and extends the Low-Income Home Energy Assistance Act of 1981. It sets appropriation levels of $2.075 billion for 1984, with annual increases to $2.800 billion in 1988. The bill also incorporates energy increases since 1978 by updating the formula for state allotments. The report includes background information on the need for and the impact of the program, along with guidelines for its implementation. A summary of agency, minority, dissenting, and additional views follows a section-by-section discussion of changes which the bill makes in existing law.

37850 **Energy conservation in public housing: it can work.** Ritschard, R.L.; Dickey, D. (Lawrence Berkeley Lab., CA). *Energy Systems and Policy;* **8**: No. 3, 269-291(1984). Contract AC03-76SF00098.

A large and growing portion of expenditures for public housing consists of energy expenses, which have risen primarily as a result of increasing prices. Studies have concluded that significant cost and energy savings may be made through the improvement of the physical conditions of the public housing stock. This research shows that weatherization and retrofit programs have been established by some local public housing authorities and that results have been encouraging. Widespread adoption of such programs is hampered by difficulties in obtaining relevant technical data. 41 references, 5 tables.

37851 **Methods of estimating air infiltration through windows.** Klems, J.H. (Univ. of California, Berkeley). *Energy and Buildings;* **5**: 243-252(1983). Contract W-7405-ENG-48.

The mechanism of air infiltration is reviewed as background for introducing a procedure that yields more reliable estimates of average infiltration rates through a window unit than do methods currently employed. The procedure is applied to estimating the average winter heat losses through windows in low-rise residential buildings variously located throughout the United States. It is concluded that, regardless of climate, the heat loss attributable to infiltration through window unit is small compared with that incurred as a result of direct transmission of heat through the window. 21 references, 4 tables.

37852 **Results of the Walnut Creek house doctor project.** O'Regan, B.C.; Dickinson, J.B.; Wagner, B.S. (Buildings Energy Data Group, Lawrence Berkeley Laboratory, University of California, Berkeley, CA). *Energy (Oxford);* **9**: No. 1, 75-85(Jan 1981). Contract AC03-76SF00098.

The results of an experiment designed to measure the additional energy savings achieved by adding two person-days of house doctoring to a standard energy audit. The authors compare a house doctor and audit treatment to an audit alone and to a passive control group. The treatments were applied to randomly selected groups of 10 houses each in Walnut Creek, California. The difference in energy savings between the treatments, based on monthly utility bills, were not statistically significant due to wide variation in savings and the loss of several houses from each group. Predicted energy savings, based in part on measured air leakage area reductions, indicated that the retrofit package completed during house doctoring had a cost of conserved energy of $4.00/GJ.

3202 Transportation

REFER ALSO TO CITATION(S) 32020037876, 37894, 37903, 37911

37853 **(AD-A—137987/4) Engineering and Services Laboratory FY85 technical objectives document. Technical programs objectives report for FY85-FY89.** Flaa, D.L. (Air Force Engineering and Services Center, Tyndall AFB, FL (USA). Engineering and Services Lab.). Dec 1983. 37p. NTIS, PC A03/MF A01.

This TOD describes the three Technical Planning Objectives developed to guide the conduct of research and development in passive defense techniques for the theater airbase, pavement studies, environmental pollution abatement and control, air mobility concepts, fire fighting equipment, and resource/energy conservation. Facilities aspects of Airbase Recovery and Rapid Runway Repair are also addressed.

37854 **(DOE/CS/56051—10) Status of gaseous fuels for use in highway transportation: a 1983 perspective.** Bechtold, R.L.; Timbario, T.J. (Mueller Associates, Inc., Baltimore, MD (USA)). Nov 1983. Contract AC05-79CS56051. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015205.

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The current status of the technologies of gaseous fuels utilization in highway transportation vehicles is reviewed. The use of natural gas included as well as liquefied petroleum gases (LPG). The results of engine and vehicle testing using gaseous fuels are presented and discussed. Topics explored include fuel properties, storage tank materials compatibility, power output, exhaust emissions, road-use taxes, vehicle refueling characteristics, crash test data, vehicle accident file analyses, operating range and vehicle performance. Special emphasis is placed on assessments of the safety of gaseous fuels compared to gasoline and diesel fuel and of the institutional barriers impeding the widespread implementation of gaseous fueled vehicles. Possible new developments in gaseous fueled vehicle technology such as methane absorbents, advanced gaseous fuel systems, optimum engine design to best make use of the properties of gaseous fuels, refueling techniques and advanced gaseous fuel vehicle design concepts are presented and discussed. Areas of gaseous fuel vehicle technology which would benefit from additional research are identified.

37855 **(DOE/CS/58435—T1) On-road fuel economy trends and impacts.** McNutt, B.; Dulla, R. (Department of Energy, Washington, DC (USA); Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 17 Feb 1979. Contract AC01-76CS58435. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014305.

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As part of an ongoing analysis of motor vehicle fuel demand, the Department of Energy has undertaken a study of light duty vehicle on-road fuel economy as it compares to the Environmental Protection Agency measured fuel economy test results for similar vehicles. The results of the first phase of this study are used in conjunction with a vehicle fuel consumption accounting model to estimate in-use fuel economy trends and to project demand for gasoline and diesel fuel by light duty vehicles. This report describes the status of the DOE data base which contains information on over 12,000 in-use vehicles of model years 1974-1977 and the most recent results of the second phase analysis. Fuel economy trends for new vehicles and the total on-road fleet are presented based on fuel economy standards requirements and the relationships between EPA and on-road fuel economy. The impact on fuel consumption of EPA/on-road fuel economy discrepancies is analyzed and projections of fuel consumption by both vehicle and fuel type are made for 1978 to 1990, based on on-road fuel economy trends, econometrically based auto sales estimates, information on vehicle miles traveled, and auto scrappage data.

37856 **(DOE/NBM—4014070) Assessment of the Federal Fuel Economy Information Program.** Pirkey, D.B. (USDOE Office of Policy, Planning and Analysis, Washington, DC). Apr 1982. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014070.

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The effectiveness of the major components of the Fuel Economy Information Program - the Gas Mileage Guide and the Fuel Economy Label is discussed and assessed. A review was made of alternative approaches for the dissemination of fuel economy information. (MHR)

37857 **(DOE/NBM—4014202) Causes of reduced automobile fuel demand and its implications for consumers: analysis memorandum.** Difiglio, C.; McNutt, B. (USDOE Office of Policy, Planning and Analysis, Washington, DC). Jan 1982. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014202.

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The changes in vehicle design and use that have reduced motor fuel consumption are examined. By concentration on disaggregated data, the specific factors which caused gasoline demand to drop are identified and any implications these factors have had for consumers are considered. The data reveal the extent to which consumers have had to reduce their demand for travel or increase their efficiency of travel to account for the 28 percent drop from projected 1981 fuel consumption. In particular, the industries impacted adversely by a decrease in fuel consumption are discussed. (MHR)

37858 **(DOE/NBM—4014203) Trends in energy use and fuel efficiency of light trucks, 1973-1980.** Marino, A.E. (USDOE Office of Policy, Planning and Analysis, Washington, DC). Sep 1982. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014203.

The purpose of this memorandum is to estimate the potential fuel savings of policy initiatives to increase the use of fuel efficient tires and oils in the existing fleet of light-duty vehicles. These estimates are derived with the aid of a Highway Fuel Consumption (HFC) model. Unpublished data from the DOE Office of Policy and Evaluation are used to develop fuel economy improvement factors and penetration rates for fuel efficient tires and oils. Using these data several cases are developed to represent a range of potential fuel savings estimates over the period 1980 to 1985 for oils and 1980 to 1990 for tires. In all instances, it is assumed that the penetration of fuel efficient tires and oils in the in-use fleet remains constant (at 1985 levels in the post-1985 time period for oils and at 1990 levels in the post-1990 period for tires.) The fleet fuel consumption impacts of fuel efficient oils are presented. Potential fuel savings from the increased penetration of fuel efficient tires are outlined.

37859 **(DOE/PE/70032—T20) Engineering analysis of shortfall for new technologies. Analysis memorandum.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 11 Mar 1981. Contract AC01-79PE70032. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014210.

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The engineering principles that govern the mpg performance of alternative technologies on the EPA test procedure and under in-use conditions are examined. The results can be used to interpret the shortfall of alternative technologies derived from statistical analyses. The analysis examines each of the four technologies in comparison to the conventional technology counterpart. Manual transmissions are compared to automatics, fuel injected S.I. engines to carburetted S.I. engines, front-wheel drive vehicles to rear-wheel drive vehicles and diesel engines to carburetted S.I. engines. The changes in shortfall of the four technologies in comparison to conventional technologies are explained through differences in responses to the factors.

37860 **(DOE/PE/70032—T22) Fuel economy of automotive vehicles - some statistical approaches.** McAdams, H.T. (Falcon Research and Development Co., Buffalo, NY (USA)). Dec 1981. Contract AC01-79PE70032. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84014220.

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Subjects covered by the paper include: interpolation, extrapolation and smoothing of time-series data; curvilinearity in the regression analysis of fuel-economy data; an approach to the regionalization of fuel-economy shortfall; and the effect of transformations of variables on the coefficient of determination (R^2) in regression analysis.

37861 **(DOE/PE/70032—T24) Fuel economy of automotive vehicles. A compendium of statistical applications.** Adams, H.T. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jun 1978. Contract AC01-79PE70032. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013848.

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The following are presented: a multiple-regression approach to the analysis of fuel-economy data; principles of statistical estimation and influence in simple linear regression; estimation and inference in multiple linear regression; and a weighted least-squares approach to regression analysis. (MHR)

37862 **(DOE/PE/70032—T25) Technology/cost segment model post-1985 automotive fuel economy analysis. Final report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 7 Nov 1981. Contract AC01-79PE70032. 139p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84014212.

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This report documents the analysis used to identify technology research and development trends and related constraints on technology introduction expected in the post-1985 time frame. It also presents a detailed discussion of the influence of lead time constraints on the ability of manufacturers to introduce new technologies. The TCSM has been altered to expand its forecasting range to 1995 and to evaluate alternative technology selection criteria. The report concludes with a review of potential fuel economy paths and alternative fuel price scenarios.

37863 **(DOE/PE/70032—T32) Automobile consumer response to fuel economy information and technology. A compendium of appendices to the final report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 23 Apr 1982. Contract AC01-79PE70032. 256p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84014190.

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The following appendices are included: guidance on allocation of Rennie Task 11 work effort; market penetration of vehicle fuel efficient technologies; automotive industry interviews; manufacturers' perceptions - tire and oil companies; recalibration of earlier survey on automotive consumer awareness, use, and evaluation

of government published fuel economy information; awareness of performance characteristics of automotive technologies; report on findings from first three focus groups; report on findings from second wave of focus groups; and report on findings from interviews with dealer sales managers; fuel economy information tolerance and cross sourcing; summary of findings from focus groups and dealer interviews; and assessment of the federal fuel economy information program.

37864 **(DOE/PE/70045—T19) Fuel purchasing patterns and vehicle use trends from the NPD research gasoline diary data base: data display.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Sep 1982. Contract AC01-78PE70045. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014195.

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The NPD data base has been developed from the Petroleum Marketing Index (PMI) market research survey. The source for PMI is a national diary panel of approximately 4100 households balanced against the U.S. Census according to demography and geographic location. Survey participants maintain diaries in which they record purchases of gasoline and motor oil for each household vehicle. The PMI survey was augmented to include EPA fuel economy numbers for post 1975 model year vehicles. The steps taken to prepare the data for analysis are discussed, including error correction, smoothing, and collapsing to monthly summary records. This preparation yields a manageable data base which includes monthly summary statistics on travel and fuel use. A statistical smoothing of fuel purchase data was used to reduce the uncertainty in fuel economy calculations introduced by the difference between fuel purchased and fuel consumed. Collapsing to monthly summaries also was done to standardize the observations across the data base to uniform time periods. An overview is given of available data on in-use fuel economy, vehicle miles of travel, and fuel demand, highlighting the quarterly trends in these variables. The data presented are divided into three parts: in-use fuel economy, vehicle miles of travel, and fuel demand and fuel prices.

37865 **(DOE/PE/70045—T22) Seasonal and regional mpg as influenced by environmental conditions and travel patterns.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Mar 1983. Contract AC01-78PE70045. 57p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014187.

In-use fuel economy shortfall varies regionally and seasonally in response to changing environmental conditions and travel patterns. Shortfall changes by 25 percent or more are associated with variations in miles travelled per day by in-use vehicles. Monthly variations in northern states are twice those in the south; air conditioning penalties also vary by region. Although regional differences in annual levels are relatively small, shortfall can increase by 16 percent in densely populated urban areas. These variations have been quantified in an analysis of time-series mpg data and related to variables commonly reported in fuel economy surveys.

37866 **(DOE/PE/70045—T23) Estimation of city and highway shortfall factors from composite shortfall relationships.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1983. Contract AC01-78PE70045. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014197.

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The expansion and refinement of existing techniques used to quantify the differences or shortfall between fuel economy measured on the EPA test procedure and fuel economy achieved by consumers on the road. A method was developed that allows the specification of separate adjustment factors for the EPA urban and highway fuel economy values. The 1980 General Motors in-use fuel economy data base was used because participants were requested to indicate the percent city driving experienced since their last fuel purchase. All results were communicated through a series of letter reports. After a brief summary of the intent and results of the project, these letters are presented in chronological order. (MHR)

37867 **(DOE/PE/70045—T24) Technology cost segment model for light-duty trucks.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Dec 1980. Contract AC01-78PE70045. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014206.

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Development of a computerized model to forecast the consumer cost of improving domestic light duty truck (LDT) fuel economy is developed. The LDT TCSM described is designed for two alternative uses: to provide technical information for econometric models of light truck sales and to be used interactively to support the analysis of specific policy issues. A means of categorizing the vehicles in the LDT market is developed and the way the truck market structure differs from that of the automobile market is explained. The methodology used to create the LDT TCSM is presented. The basic automotive TCSM (Technology/Cost Segment Model) was altered to incorporate upcoming changes in the LDT market. New models and technologies used in the LDT TCSM are described. TCSM construction and operation are explained. Special attention is devoted to explaining the model structure which accounts for engineering, marketing, and manufacturing constraints on new technology introduction. Appendix A provides an exhaustive listing of the data sources used in compiling the cost matrices. Appendix B lists the cost matrices; Appendix C contains sales projections for use in calculating aggregate fuel economy levels for manufacturers and size classes.

37868 **(N—8330061) OPTIM: Computer program to generate a vertical profile which minimizes aircraft fuel burn or direct operating cost. User's guide.** (Analytical Mechanics Associates, Inc., Mountain View, CA (USA)). May 1983. 120p. (NASA-CR—166061). NTIS, PC A06/MF A01.

A profile of altitude, airspeed, and flight path angle as a function of range between a given set of origin and destination points for particular models of transport aircraft provided by NASA is generated. Inputs to the program include the vertical wind profile, the aircraft takeoff weight, the costs of time and fuel, certain constraint parameters and control flags. The profile can be near optimum in the sense of minimizing: (1) fuel, (2) time, or (3) a combination of fuel and time (direct operating cost (DOC)). The user can also, as an option, specify the length of time the flight is to span. The theory behind the technical details of this program is also presented.

37869 **(P—300-83-013) California freight energy demand model.** (Faucett (Jack) Associates, Inc., Chevy Chase, MD (USA)). Sep 1983. 240p. California Energy Commission, 1516-19th Street, Sacramento, CA 95814. Order Number TI84901648.

The California Freight Energy Demand Model has been developed to assist the California Energy Commission in forecasting rail-freight and truck fuel consumption in California and in exploring the effects of alternative scenarios on future fuel consumption. The model projects the volume of freight transported by truck and rail, truck stock and vehicle miles traveled, and truck and rail consumption of four types of fuel [gasoline, diesel fuel, liquified petroleum gas (LPG), and methanol]. The projections are developed for 17 activities/commodities and 5 regions (San Francisco, Los Angeles, San Diego, Sacramento, and the rest of the state). The truck projections are also developed for 40 categories of size and body type. Internally, the model also distinguishes intrastate freight movements and four categories of interstate movements, and trucks are distinguished by age and whether they are generally used for local or nonlocal operation. The model develops projections from 1977 through 2004 based, in part, on exogenous projections of economic growth, by sector; fuel costs, by fuel type; other influences on transport costs, by model; and trends in rail and freight fuel efficiency.

37870 **(P—400-83-004) Fuel efficient traffic signal operation and evaluation: Garden Grove Demonstration Project.** (Wagner-McGee Associates, Inc., Alexandria, VA (USA)). Feb 1983. 76p. California Energy Commission, 1516-9th Street, Sacramento, CA 95814. Order Number TI84901647.

The procedures and results of a case study of fuel efficient traffic signal operation and evaluation in the City of Garden Grove, California are documented. Improved traffic signal timing was developed for a 70-intersection test network in Garden Grove using an optimization tool called the TRANSYT Version 8 computer program. Full-scale field testing of five alternative timing plans was conducted using two instrumented vehicles equipped to measure traffic performance characteristics and fuel consumption. The field tests indicated that significant improvements in traffic flow and fuel consumption result from the use of timing plans generated by the TRANSYT optimization model. Changing from pre-existing to an optimized timing plan yields a networkwide 5 percent reduction in total travel time, more than 10 percent reduction in both the number of stops and stopped delay time, and 6 percent reduction in fuel consumption. Projections are made of the benefits and costs of implementing such a program at the 20,000 traffic signals in networks throughout the State of California.

37871 **(PB—84-156140) Hydrodynamic aspects of energy conservation in commercial ship design. Final report Oct 78-Oct 82.** Robinson, J.H. (David W. Taylor Naval Ship Research and Development Center, Bethesda, MD (USA). Ship Performance Dept.). Nov 1982. 97p. NTIS, PC A05/MF A01.

With an ultimate objective of fostering more efficient use of energy in future U.S. Flag merchant ships, pertinent data on novel stern shapes, appendages, and propulsors were analyzed to determine possible degree of improvement, extent of applicability, and needed development relative to improving the speed/power performance of commercial ships. Additionally low block coefficient hull form design state-of-the-art was reviewed to determine adequacy of existing guidance. Concurrently an experimental evaluation of the propulsive effectiveness of a tandem propeller on a high powered containership model was made with promising results.

37872 **(PNL—5191) ECUT energy data reference series: Otto cycle engines in transportation.** Hane, G.J.; Johnson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015272.

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Information that describes the use of the Otto cycle engines in transportation is summarized. The transportation modes discussed in this report include the following: automobiles, light trucks, heavy trucks, marine, recreational vehicles, motorcycles, buses, aircraft, and snowmobiles. These modes account for nearly 100% of the gasoline and LPG consumed in transportation engines. The information provided on each of these modes includes descriptions of the average energy conversion efficiency of the engine, the capital stock, the amount of energy used, and the activity level as measured in ton-miles. Estimates are provided for the years 1980 and 2000.

37873 **(PNL—5192) ECUT energy data reference series: lightweight materials for ground transportation.** Abarcar, R.B.; Hane, G.J.; Johnson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015269.

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This report summarizes information that describes the use of lightweight materials in automobiles. The information on this mode of transportation represents the largest potential energy savings for substitution of lightweight materials in the transportation sector. Included are data on energy conversion efficiency of the engine and its relationship to vehicle weight, the capital stock, the amount of energy used, and the service activity level as measured in ton-miles.

37874 **(PNL—5193) ECUT energy data reference series: high-temperature materials for advanced heat engines.** Abarcar, R.B.; Hane, G.J.; Johnson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015352.

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Information that describes the use of high-temperature materials in advanced heat engines for ground transportation applications is summarized. Applications discussed are: automobiles, light trucks, and medium and heavy trucks. The information provided on each of these modes includes descriptions of the average conversion efficiency of the engine, the capital stock, the amount of energy used, and the activity level as measured in ton-miles.

37875 **Non-metallic research activities in the Office of Vehicle and Engine R and D, US Department of Energy.** Schulz, R. (Dept. of Energy, Washington, DC). *Materials and Society;* 8: No. 2, 173-181(1984).

Program goals, common technology barriers, and current projects in automotive gas turbines, advanced diesel technology, and advanced materials development are designed to provide the automotive industry with proof of concepts for advanced heat engine technology that will improve gas mileage 30%, meet environmental standards, provide an alternative fuel capability, and have competitive initial life-cycle costs. After reviewing the program, the author concludes that successful development of high temperature ceramic components for advanced heat engines will have major impact on many strategic material applications and that the introduction of advanced (low-emission) heat engines for automobiles would reduce the use of platinum for catalytic convertors. 1 figure, 1 table.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 32030037107, 37110, 37111, 37112, 37114, 37830, 37875

37876 **(ANL—83-101) Waste heat recovery fluids for heavy-duty transportation bottoming cycle systems: a summary report.** Krazinski, J.L.; Uherka, K.L.; Holtz, R.E.; Ash, J.E. (Argonne National Lab., IL (USA)). Jul 1984. Contract W-31-109-ENG-38. 64p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84015447.

Working fluids used in Rankine bottoming cycle systems for heat recovery from long-haul trucks, marine vessels, and railroad locomotives are examined. Rankine bottoming cycle systems improve fuel economy by converting the exhaust heat from the prime mover into useful power. The report assesses fluid property requirements on the basis of previous experience with bottoming cycle systems. Also, the exhaust gas characteristics for the transportation modes of interest are summarized and compared. Candidate working fluids are discussed with respect to their potential for use in Rankine bottoming cycle systems. Analytical techniques are presented for calculating the thermodynamic properties of single-component working fluids. The resulting equations have been incorporated into a computer code for predicting the performance of Rankine bottoming cycle systems. In evaluating candidate working fluids, the code requires the user to input only a minimal amount of fluid property data.

37877 **(BMFT-FB-T—84-058) Efficient use of the heat resulting from the sulphuric acid production process for the concentration of washing-acids and spent acids containing solids.** Suelzer, B.; Doni, J.; Peichl, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Sued Chemie A.G., Muenchen (Germany, F.R.)). Apr 1984. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751903.

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Low-temperature process heat is utilized for concentration of the acid residues of gas purification and other recirculation processes. The most efficient heat recovery process is by indirect heat transfer from the acid circuits of the sulphuric acid production facility to the acid circuits of the concentrating facility. Acid concentration takes place at relatively low temperature and water vapour partial pressure as a function of acid temperature and concentration. The crystallizing solids are removed by filter pressing.

37878 **(BMFT-FB-T—84-072) Design and engineering of a gas-engine driven heat pump heating station including heat distribution system and utilization of waste heat from an ice rink for the residential area Dorsten - Maria Lindenhof.** Huelsemann, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Kraftanlagen-Planungs G.m.b.H., Heidelberg (Germany, F.R.)). May 1984. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84751935.

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A gas-engine driven heat pump heating station including the required heat destribution system and utilization of waste heat from an ice rink to be realized in the residential area Dorsten - Maria Lindenhof. The total heat capacity was to be reached in two stages, corresponding to the progress of the building and housing structure in this specific area: First stage of construction 5,6 MW, final stage of construction 7,6 MW. With regard to the final stage of construction only a relatively small part of the buildings is provided with heating systems designed for supply and return temperatures of 90/70°C respectively. The old people's home built in 1980 was already equipped with low temperature heating systems and all buildings still to be built shall be provided with low-temperature systems. As far as old heating systems are concerned, the required measures must be taken to reduce the temperature in the return lines.

37879 **(BMFT-FB-T—84-086) Energy-heat-coupling with waste heat from a discontinuous manufacturing plant.** Thomas, A.; Beier, W.; Getschmann, E.; Germersheim, K. von; Gruenewald, F.; Kaskas, A.A.; Klages, R.; Kossbeck, W.; Schmidt, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Hoesch Werke A.G., Dortmund (Germany, F.R.)). May 1984. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751938.

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In the course of a project study preceding that of the performance phase it was intended to clear up in a reliable way whether it would be technically possible and economically justifiable to recuperate the sensible heat contained in the hot exhaust gases of the pushertype furnaces at the wide strip rolling mill of the Hoesch Huettenwerke AG (HHW), to use this heat for the generation of steam and auxiliary power (energy-heat coupling) and to feed the remaining heat into the steam mains of the Vereinigte Elektrizitaetswerke AG (VEW) passing at the borders of the plants. The elaborated technical solution provides for an energy-heat coupling with a direct steam supply into the network of the VEW where two steam mains with completely different generation and delivery characteristics are connected together. In addition thereto, the HHW undertakes to ensure the supply of the VEW. All the calculations are perhaps yielding only a moderate profitability, but all the advantages presented by power-production and relating to economics are speaking in favour for the realization of the project.

37880 **(CONF-8406157—1) Economics of industrial cogeneration with a residual-oil-fired low-speed diesel.** Santini, D.J.; Belak, F.J.; Bernard, M.J.; Stodolsky, F.; Suchy, K.W. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014735.

From Conference on energy, power and environmental systems; San Francisco, CA, USA (4 Jun 1984).

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The only residual-oil-fired low speed diesel cogeneration facility in the US has been in operation for a year at the Hoffman-LaRoche Vitamin C plant in Belvidere, NJ. Operating data for this grid-connected 23 MW facility are used to construct a generic evaluation of the economic desirability of such systems for industrial electric/thermal applications and industrial-thermal/commercial-electrical applications made possible by recent US legislation (PURPA). The post 1980 changes in relative electrical and residual oil prices are shown to have made oil fired on-site generation more attractive. The likely 1985-2005 movements of electricity and residual oil prices are discussed, along with risks of error in projections. The system is evaluated as a whole and on an incremental basis. Incremental analysis includes (1) the economics of steam and hot water use given the diesel and (2) the economics of system generation given industrial electric, steam and hot water loads. The sensitivity of the economics of the system to the full range of US electricity and residual oil prices is estimated. The effect of variation in system loads is examined. The economic desirability of the system is often great but is also highly variable geographically, largely as a function of local evaded electricity charges.

37881 **(DOE/CE/15148—T7) Dual tube counter flow heat exchanger. Final report. WEC Project No. 513.** (Wilhelm Engineering Co., Inc., Ashland, WI (USA)). 12 Jul 1984. Contract FG01-82CE15148. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014900.

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Progress is reported on the use of the dual tube counter flow heat exchanger in a poultry barn. Results are shown and the payback period is estimated to be less than one year. (MHR)

37882 **(DOE/CS/40402—T4) DOE Industrial Energy Conservation Program.** (Department of Energy, Washington, DC (USA). Office of Industrial Programs). 1984. Contract AC01-80CS40402. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012880.

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The background, function, technical achievements, and plans of the Industrial Energy Conservation Program are described. Technical achievements are presented in the areas of waste energy reduction, cogeneration, and industrial process efficiency. A list of research and development contractors is included. (MHR)

37883 **(DOE/PE/70032—T14) Analysis of the fuel consumption impact of fuel economy standards for MY 1983-1985 light-duty trucks.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). 30 Jan 1981. Contract AC01-79PE70032. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013789.

Fuel savings attributable to compliance with the final rulemaking by DOT have been estimated with the use of the Highway Fuel Consumption model. The analysis assumes that the domestic light truck manufacturers meet (and do not exceed) the composite CAFE standards for MY 1983-1985 without the use of diesels. This assumption corresponds with that used in the DOT regulatory analysis of the rulemaking. Fuel savings through the year 2000 are calculated using 1982 fuel economy levels as a baseline. These estimates are then compared with those developed by the DOT.

37884 **(DOE/RA/08741—T1) Impact of increased diesel fuel use on the petroleum refining industry and on crude oil consumption.** (Sobotka and Co., Inc., Stamford, CT (USA)). 26 Nov 1979. Contract AC01-77RA08741. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014192.

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No. 2 home heating oil and diesel fuel are similar products and in most cases interchangeable. Some small fraction of US heating oil supplies may not be of suitable burning quality to satisfy the most severe diesel engine requirements. And occasionally some diesel fuel may not have good enough stability or low temperature flow characteristics to be sold as home heating oil. Historically the refinery gate prices of the two products have reflected the similarity. Generally, diesel fuel has sold for a modest premium of about one quarter of a cent per gallon. If the demand for diesel fuel increases, the initial new supply will generally improve the aggregate US distillate pool burning quality and stability. And if kerosene - type jet fuel consumption is eventually replaced with a naphtha-type fuel, improved low temperature flow characteristic, will result. SCI forecasts no significant changes are likely in the refinery gate price differences between No. 2 fuel oil and diesel fuel.

37885 **(IS—4842) Direct utilization-recovery of minerals from coal fly ash. Fossil Energy Program technical progress report, 1 April 1983-30 June 1983.** Burnet, G.; Murtha, M.J. (Ames Lab., IA (USA)). Jul 1983. Contract W-7405-ENG-82. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015018.

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A better understanding of the HiChlor process reaction mechanism was sought through a comprehensive study of the literature and a review of experimental data from work done at the Ames Laboratory. In the process, the oxides of Al, Fe, and Ti present in fly ash are extracted by high temperature chlorination in the presence of a solid or gaseous reductant. Information about the reactions involved is required for process development and for reactor design and operation. Three reaction mechanisms were proposed and evaluated. Other work dealt with feed preparation for two HiChlor process reactor configurations: packed and fluidized beds. Durable pellets of carbon fly ash mixtures are required in packed beds, and similar but smaller pellets are required in fluidized beds to prevent elutriation of the fine particles of fly ash out of the reactor. Work was expanded on the carbochlorination of coal fly ash in a fused salt ($AlCl_3$-NaCl) medium. Chlorination in a fused salt medium has the potential advantages for high reaction rates for a wide range of reaction conditions. The design and fabrication of an experimental, bench scale apparatus is nearly complete. Research on the sinter processes for extracting aluminates from coal fly ash focused on a more complete evaluation of the effects of particle size of both the raw materials and the sintered clinker on the yield of alumina and on process economics. An investigation of aluminate recoveries as a function of temperature showed potential for ambient temperature extractions. 13 references, 9 figures, 3 tables.

37886 **(IS—4846) Direct utilization: recovery of minerals from coal fly ash. Fossil Energy program, technical progress report, July 1, 1983-September 30, 1983.** Burnet, G.; Murtha, M.J. (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015019.

Portions are illegible in microfiche products. Original copy available until stock is exhausted; thesis.

Work has focused on two methods for resource recovery from coal conversion solid wastes. The HiChlor Process recovers Al, Fe, and Ti minerals from coal fly ash by high temperature chlorination in the presence of a reductant. An understanding of the mechanisms of the gas-solid reactions involved is essential to the design and development of the reactor system. Three possible reaction mechanisms are considered, evaluated, and tested. The second method involves a lime-sinter step to produce soluble aluminates. Research on the process includes scale-up of the sinter step using a 5 in. diam electrically heated kilm. Batch samples of limestone-fly ash-soda ash mixtures are processed, at a rate of about 4 lb/hr. The resulting clinker is used to fully evaluate processing conditions for the extraction, desilication, and product recovery steps. Experiments are completed which evaluate raw material preparation requirements, for sintering and clinker crushing requirements for extraction.

37887 **(IS—4853) Direct utilization - recovery of minerals from coal fly ash. Fossil energy program technical progress report, 1 October 1983-31 December 1983.** Burnet, G.; Murtha, M.J. (Ames Lab., IA (USA)). Mar 1984. Contract W-7405-ENG-82. 55p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84015020.

This research deals with resource recovery from coal conversion solid wastes. A reaction model for the carbochlorination of coal fly ash with phosgene is described which predicts fly ash reactivity as a function of time for the range of experimental conditions investigated. Kinetic data and information gained by examination of solids using x-ray photoelectron spectroscopy, scanning electron microscopy, x-ray diffraction analyses, and phosgene dissociation measurements were used in the development of the model relationship. The carbochlorination of fly ash with solid carbon reductant requires close proximity (less than 40 microns) between ash and carbon particles. This necessity, together with handling and process requirements, suggests that a fly ash-carbon mixture can be reacted in the form of homogeneous, hardened pellets. The most economical solid carbon to use would be raw coal if the volatile matter can be removed during heat treatment to harden the pellets. Coal-fly ash pellets were formed and heat treated in an oxidizing atmosphere. When the fired pellets were then heated in an inert atmosphere, little additional devolatilization occurred. Preparation of ash-coal pellets with devolatilization of the coal during pellet heat treatment could significantly decrease the production costs for the HiChlor process. Tests were also conducted which showed that mixture reactivity was not decreased by either the agglomeration or the heat treatment. As part of an examination of the mechanisms of the gas-solid process reactions, data from several new literature sources were reviewed. Work was continued on optimization and evaluation of the lime-sinter processing method which uses a high temperature sintering step to form soluble aluminates. 16 references, 22 figures, 6 tables.

37888 **(IS—4860) Direct utilization- recovery of minerals from coal fly asy. Fossil energy program technical progress report, 1 January 1984 - 31 March 1984.** Burnet, G.; Murtha, M.J. (Ames Lab., IA (USA)). Jun 1984. Contract W-7405-ENG-82. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84015006.

Research is reported for two methods for extracting metal values from power plant fly ash. In the first method (HiChlor process), a carbochlorination reaction is used to produce a mixture of volatile metal chlorides from the oxides in the ash. Fractional condensation of the mixed chlorides is being investigated as the first step in their recovery and separation. This effort is accompanied by work on a unique slurry reactor in which the ash is contacted by gaseous chlorine while suspended with finely divided carbon in a molten salt mixture consisting of NaCl and $AlCl_3$. In the second method, a lime-sinter solid state reaction is used to selectively convert the alumina in the ash to a soluble form. The alumina is recovered by leaching the finely divided clinker. The effects of mineralizers on the sinter reaction are being investigated as a means for increasing alumina yield and reducing the temperature required. A similar study is underway to determine the degree to which the limestone required can be replaced by flue gas scrubber sludge which also has mineralizer properties. Preliminary results show that at least 30% of the limestone can be replaced. Attempts to reduce the sintering temperature required have also been carried out using a laboratory scale rotary kiln. Through kiln modifications, residence time has been increased so that lower temperatures can be used. The alumina-containing extract from the leaching of the clinker will occasionally contain excessive amounts of silica. To meet electrolytic cell feed specifications, the silica content is reduced by digestion with a small amount of lime. Work has been completed on an update of an economic feasibility study of the lime-sinter process. 13 figures, 8 tables.

37889 **(ORNL/Sub—83-13876/1) Chemical heat pump state-of-the-art survey. Final report.** Hanna, W.T.; Krause, H.H.; Friedel, W.; Yanase, Y. (Battelle Columbus Labs., OH (USA)). 10 Aug 1983. Contract AC05-84OR21400. 301p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84013552.

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In addition to the survey of industrial chemical heat pumps (ICHP) in the US, both the European and Japanese (CHP) developments were surveyed. This survey is reviewed and the ICHP's are grouped by temperature range. (MHR)

37890 **(PB—84-184324) Economics of energy at sawmills. Special report.** Taylor, R.W. (National Timber Research Inst., Pretoria (South Africa)). Jan 1983. 50p. NTIS, PC E04/MF E01.

The aim of the study was to analyse the use of energy at sawmills, detailing the types, quantities, sources, fuels and costs used, and to discuss the possible alternates that were available to enable the industry to strive towards energy self-sufficiency. From the conclusions drawn, recommendations were to be made regarding the direction that research should take in order to assist the industry in its move towards self-sufficiency.

37891 **(PB—84-186543) Recovery and use of byproducts in the pulp and paper industry: a development study. Subject survey.** Male, J.R. (National Timber Research Inst., Pretoria (South Africa)). Apr 1983. 19p. NTIS, PC E03/MF E01.

The objective of this study is to review available literature to become abreast of the technology for recovery and utilization of byproducts as found in the pulp and paper industry, excluding uses

for bark and lignin derivatives which are catered for in separate studies.

37892 **(PB—84-186915) Pulse combustion residential water heater, December 1982-November 1983. Annual report.** Kolodgy, R.J.; Fuller, J.J. (American Gas Association Labs., Cleveland, OH). Dec 1983. 44p. NTIS, PC A03/MF A01.

See also PB83-167221.

The study was undertaken to develop ultra efficient domestic water heaters of the pulse combustion type. Testing is focused on intermediate size (40 and 50 gallon) water heaters. Both 40 and 50 gallon models will employ like combustion system componentry which are developed to operate at 42,500 Btu/hr. The objective is to demonstrate DOE recovery efficiencies of 92 percent or greater and/or service efficiencies of 85 percent or greater. A.G.A.L., GRI and the participating manufacturer are cooperating in the design of the storage vessel and combustion system components. This report contains progress and barriers which have accompanied the development of the water heaters. Energy balance evaluations prove to be an important tool in focusing future modifications.

37893 **(PNL—5194) ECUT energy data reference series: ammonia synthesis energy-use and capital stock information.** Young, J.K.; Johnson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015273.

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Energy requirements for ammonia synthesis totaled 0.55 quadrillion Btu of natural gas in 1980 and 28,500 MMBtu (8.3×10^6 kWh) of electricity. Efficiencies ranged from 0.72 to 0.8 for natural gas and 0.65 for electricity. Ammonia production in 1980 is estimated at 21 million tones. In the year 2000, U.S. ammonia production is estimated to be between 27 to 34 million tones with 19 to 31 million tons being produced using natural gas. A most likely value of 25 million tons of ammonia from natural gas feedstock is projected. As much as 20% of the energy from natural gas fuel could be saved if a more active catalyst could be developed that would reduce the operating pressure of ammonia synthesis to 1 atm.

37894 **Industrial energy conservation technologies and research opportunities.** De Renzo, D.J. (ed.). Park Ridge, NJ; Noyes Data Corporation (1983). 719p. (DOE/RL/01830—T22). Noyes Data Corp., Mill Rd., Park Ridge, NJ 07656. Order Number TI84014553. Contract AC06-76RL01830.

This book assesses and evaluates energy technologies currently available for application to industrial energy conservation. Also considered are research needs for developing advanced technologies for efficient energy use. Part I assesses and evaluates information on the newer energy technologies offered commercially. The primary objective of this evaluation was to identify technologies that had potential for saving energy in applications in industry. Once these technologies were identified, concise summaries on potential energy savings, economics, basic operational considerations and potential applications were prepared. Part II is a study of research opportunities important to developing advanced technologies for efficient energy use. It describes a wide array of attractive technical areas from which specific research and development programs could be implemented. Research areas are presented for potential application in each of the major energy end-use sectors. Part III provides a review and synthesis of several significant studies that were conducted to assess R and D needs and opportunities for advanced energy conservation systems.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 32060037771, 37807, 38638

37895 **(DOE/CS/20441—3) District heating and cooling systems for communities through power plant retrofit and distribution network. Final report of the City of Piqua, Ohio.** (Resource Development Associates, Inc., Dayton, OH (USA)). Nov 1983. Contract AC02-78CS20441. 553p. NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE84014855.

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The following are reported: thermal and electrical load analysis, alternative service areas, power plant analysis and thermal supply options, technical district heating development branch, air quality impact analysis, institutional considerations and evaluations, energy market evaluation, energy and economic development, energy and economic development, and economic and financial analysis. (MHR)

37896 **(DOE/CS/20441—3-App.1) District heating and cooling systems for communities through power plant retrofit and distribution network. Final report, Appendix 1.** (Resource Development Associates, Inc., Dayton, OH (USA)). Nov 1983. Contract AC02-78CS20441. 249p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE84014854.

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The appendices cover boiler testing, inspection, and operation and the turbine rerate study. (MHR)

37897 **(DOE/CS/20441—3-App.2) District heating and cooling systems for communities through power plant retrofit and distribution network. Appendix 2 to the final report of the city of Piqua, Ohio. Design/build construction approach.** (Resource Development Associates, Inc., Dayton, OH (USA); Resource Development Associates, Inc., Atlanta, GA (USA)). Nov 1983. Contract AC02-78CS20441. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84014393.

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The following are included: the explanation and results of the design/build approach; design/build firm selection criteria; candidate design/build firms; Midwesco energy system scope of work, Piqua/Midwesco contract; Midwesco work product; and assorted, relevant memoranda. (MHR)

37898 **(DOE/CS/20441—3-App.3) District heating and cooling systems for communities through power plant retrofit and distribution network. Appendix 3 to the final report of the city of Piqua, Ohio. General project documentation.** (Resource Development Associates, Inc., Dayton, OH (USA); Resource Development Associates, Inc., Atlanta, GA (USA)). Nov 1983. Contract AC02-78CS20441. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84014534.

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The following are included: load duration curves; Piqua Municipal Power System power plant emissions analysis; resource recovery analysis; and supporting rate studies. (MHR)

37899 **(DOE/RA/50364—T1) Feasibility of implementing a municipal waste-to-energy system to supply Youngstown thermal with a solid fuel or steam system.** (Battelle Columbus Labs., OH (USA)). 1984. Contract FG01-80RA50364. 235p. NTIS MF A01; 2; GPO Dep. Order Number DE84010735.

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The municipal solid waste and economics of disposal are discussed. Youngstown Thermal's existing system and its economics are described. The technical feasibilities of refuse-derived fuels and refuse mass-burning are explored. Economic evaluations and institutional considerations are included. (MHR)

37900 (DOE/SF/11958—T1) Municipal solid waste energy conversion study on Guam and American Samoa. (Barrett, Harris and Associates, Inc., Menlo Park, CA (USA); Gibbs and Hill, Inc., San Jose, CA (USA)). 31 Mar 1984. Contract AC03-83SF11958. 172p. NTIS, PC A08; 3; GPO Dep. Order Number DE84008564.

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In the Pacific Islands of Guam and Tutuila in American Samoa, conversion of municipal solid waste to useable energy forms - principally electricity but possibly steam - may hold promise for reducing economic dependence on imported petroleum. A secondary benefit may be derived from reduction of solid waste landfill requirements. At the preliminary planning stage, waste-to-energy facilities producing electricity appear technically and environmentally feasible. Economically, the projects appear marginal but could be viable under specific conditions related to capital costs, revenue from garbage collection and revenue from the sale of the energy generated. Grant funding for the projects would considerably enhance the economic viability of the proposed facilities. The projects appear sufficiently viable to proceed to the detailed planning stage. Such projects are not viable for the islands now emerging from the US Trust Territory of the Pacific Islands.

37901 (EPRI-EA—3585-Vol.1) Electric utility conservation programs: assessment of implementation experience. Volume 1. Project overview and major findings. Final report. Davis, T.D.; Limaye, D.R. (Synergic Resources Corp., Bala-Cynwyd, PA (USA)). Jul 1984. 60p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920463.

The primary focus of the project was to identify the lessons learned by 13 case study utilities in conservation program design, operation, marketing/communication, and evaluation. The project also addressed the influence of utility system characteristics and their environmental factors on conservation program goals, and examined the degree to which benefit/cost analysis and market research were used in program design and marketing. Conservation programs have been classified in this project into five types: information programs, direct technical assistance, financial incentives, rates and demonstration programs. A summary and synthesis of the experience of the case study utilities in implementing these programs has been provided, emphasizing both strategic and tactical considerations.

37902 (EPRI-EA—3585-Vol.2) Electric utility conservation programs: assessment of implementation experience. Volume 2. Project results. Final report. Davis, T.D.; Limaye, D.R. (Synergic Resources Corp., Bala-Cynwyd, PA (USA)). Jul 1984. 325p. Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920471.

The primary focus of the project was to identify the lessons learned by 13 case study utilities in conservation program design, operation, marketing/communication, and evaluation. The project also addressed the influence of utility system characteristics and their environmental factors on conservation program goals, and examined the degree to which benefit/cost analysis and market research were used in program design and marketing. Conservation programs have been classified in this project into five types: information programs, direct technical assistance, financial incentives, rates and demonstration programs. A summary and synthesis of the experience of the case study utilities in implementing these programs has been provided, emphasizing both strategic and tactical considerations.

37903 (PB—84-182070) Comparative evaluation of energy management models for transit systems. Final report Sep 80-Dec 83. Nene, V.D. (Transtech International, Inc., Falls Church, VA (USA)). Feb 1984. 419p. NTIS, PC A18/MF A01.

Recent advances in solid state control technology have led to chopper-controlled propulsion systems in urban rail transit applications. Such systems offer the potential for superior train performance through increased train propulsion efficiency and reduced train operating costs. The present program sponsored by the Urban Mass Transportation Administration studies the energy consumption characteristics of an urban rail system equipped with transit cars having solid-state chopper-controlled propulsion systems. The program objectives include the measurement of the transit system energy consumption during revenue and nonrevenue service operation and the study of the relative accuracy of current energy management models for predicting energy consumption in urban rail systems. This report summarizes the program accomplishments in the Bay Area Rapid Transit (BART) energy consumption tests and the validation of energy management models developed by private industry. The energy consumption of BART transit cars was measured with and without regeneration during the period of August 25, 1981 through September 2, 1981. The test data was then compared with the predictions of different energy management models currently in use for transit system studies. This report presents the results of the comparative evaluation of these models.

37904 (TVA/PUB—84/44) Potential for resource recovery from municipal solid waste in Colbert and Lauderdale Counties, Alabama. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). Mar 1981. 147p. NTIS, PC A07/MF A01. Order Number DE84901609.

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Options are described for developing a viable solid waste energy recovery project in a two-county region which is a part of the Northwest Alabama Council of Local Governments. Single-county projects were also invested but were less economically attractive and were consequently dropped from further consideration.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 32090037419, 37753, 37781

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 33000037875

37905 (ORNL/TM—8896) Ceramic technology for advanced heat engines program plan. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84013567.

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A plan for a generic ceramic research effort that supports and parallels existing advanced heat engine programs is presented. This long-range plan is to identify technology base needs; coordinate activities with other industry, government, and university programs; and develop a multiyear technical and resource agenda. (MHR)

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 33010037872, 37874

37906 (AD-A—138148/2) Microwave-enhanced ignition in diesel engines. Final report 13 Jul-30 Dec 83. Bass, R.M.; Chachich, A.C. (BDM Corp., Houston, TX (USA)). 15 Dec 1983. 21p. NTIS, PC A02/MF A01.

The ignition technique consists of inserting a horseshoe-shaped wire (igniter) with sharpened ends into a microwave field. When the field is sufficiently intense, an arc forms across the tips, effectively acting as a spark plug. Tests were conducted in a special instrumented waveguide section that could be irradiated with up to 2500 watts of microwave power. The igniter was tested by inserting it into the waveguide test section and increasing the microwave power until an arc was observed. Combustion tests were conducted by inserting the igniter and a small amount of fuel into a quartz tube. The tube was sealed, inserted into the waveguide, and preheated to vaporize the fuel. Microwave power was applied to induce an arc in the igniter. The tube was then removed from the

waveguide and cooled, and the condensates were examined to verify that combustion occurred.

37907 **(BMFT-FB-T—84-038) Cooling of exhaust gases and reduction of pollutant emission for pre-chamber diesel engine.** Fechtner, L.; Ruffer, N.; Brauer, H.; Herbst, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1984. 100p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751837.

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Cooling of exhaust gases and reduction of pollutant emission for a pre-chamber diesel engine. Investigations in conjunction herewith were conducted at a unit-type station for the co-generation of heating and electrical power. The generator involved was driven with the aid of a pre-chamber diesel engine. At a speed of 1450 rpm, the measured mechanical output rating was 90 kW, and the determined thermal output was 120 kW. The electrical power which was generated was used either for station auxiliaries, or was fed into the public power grid. In the case studied here, the thermal energy was utilized for heating purposes. One advantage of such co-generation power plants is the highly efficient plant load factor. With such plants, the electricity/heat/loss-ratio approximately amounts to 35/50/15. One disadvantage, of course, for such plants is the relatively high degree of pollutant emission. In comparison with a conventional heating boiler plant, the emissions of soot and nitric oxide here are approx. ten times as great. In order to reduce pollutant emission and to improve the energy efficiency of such plants, the test plant featured the following: secondary treatment of exhaust gas, recirculation of exhaust gas, and cooling of the exhaust. By means of adding magnesium oxide, which was mixed in with the exhaust-gas stream, the concentration of sulfur dioxide was reduced to 50 ppm. By means of a scrubber device basically consisting of a cyclone dust separator and a bag filter, 99.9% of the soot as well as of the dust was able to be precipitated. With the aid of a secondary exhaust-treatment system consisting of a plastic heat exchanger and a heat pump, the exhaust gases were able to be cooled down to 20°C. As a result, the gross calorific value of the fuel was able to be utilized, which improved the overall efficiency of the plant by 7%. One result of feedback of the exhaust gas was reduction of the nitric oxide concentration from 750 ppm to 100 ppm.

37908 **(DOE/NASA—0168-7) Advanted gas turbine (AGT) technology project. Seventh semiannual report, 1 January 1983-30 June 1983.** (General Motors Corp., Indianapolis, IN (USA). Allison Div.). Jun 1984. Contract AI01-77CS51040. 65p. (NASA-CR—174629). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015164.

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The objective of this project is to develop and demonstrate, by November 1986, an advanced automotive gas turbine that will, when installed in a 1985 Pontiac Phoenix vehicle of 1360 kg inertia weight, achieve a fuel economy of 18.1 Km/L (42.5 mpg), meet or exceed the 1985 emission requirements, and have alternate fuel capability. Progress is reported on the development of engine, components, and ceramic materials. (MHR)

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 33020037874

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 33030037734

37909 **(DOE/NV/10116—1) Electric and Hybrid Vehicle Demonstration Project. Final project report.** (Lynwood, City of, CA (USA)). 1984. Contract FC08-80NV10116. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014622.

Difficulties involved in the electric vehicle demonstration of the City of Lynwood, California are detailed. The project was stated to be a limited success. (MHR)

37910 **(DOE/R8/06037—T1) Summary of activities pertaining to utilization of grant purchase of batteries for electric van. Final report.** Knabach, W.E. (South Dakota State Univ., Brookings (USA)). 3 Dec 1983. Contract FG48-81R806037. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015793.

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Experience with industrial batteries for the Battronic Electric Van are described. The operation of the van and battery charging problems are discussed. (MHR)

37911 **DOE progress in electric vehicles.** Hollander, E. (EPRI Office, Washington, DC). *EPRI (Electric Power Research Institute) Journal;* **9**: No. 5, 32-34(Jun 1984).

Eight years after Congress passed the Electric and Hybrid Vehicle Research, Development, and Demonstration Act DOE is continuing this work with an $11.7 million appropriation for fiscal year 1984. While focusing on promising lead-acid and nickel-iron batteries, the program is also studying zinc-bromide, sodium-sulfur, and lithium-metal sulfide batteries as well as fuel cells for electric vehicles (EVs). DOE, the Electric Power Research Institute, and others have succeeded in overcoming some of the inherent drawbacks to EVs by extending travel distance and battery life. Utilities see EVs as a load-leveling device. EV market penetration of only 10% will be viewed as a commercial success.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 33040037909

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 33060037939

3307 Emission Control

37912 **(PB—84-189679) Catalyst Activity Test Sequence (CATS). Technical report.** Danyko, D.D.; Watson, W.W. (Environmental Protection Agency, Ann Arbor, MI (USA). Engineering Operation Div.). Jan 1984. 16p. NTIS, PC A02/MF A01.

The primary objective of this program was to establish vehicle operating modes during which a temperature rise across the catalytic converter could be measured and used for determining the catalyst activity. The results of twenty-five (25) vehicle tests are reported. Seventeen (17) vehicle tests were conducted using known good converters, six (6) using dead converters and two (2) using partially-active (lead-poisoned) converters. The test sequence consisted of a series of five engine operating modes. In general, with careful thermocouple attachment to the exhaust pipe surface at the inlet and output of the converter, active converters show a large enough temperature rise that they can be distinguished from dead converters.

3308 Alternative Fuels

37913 **(DOE/CE/50036—T4) Advanced concepts for methanol fuel vehicles.** Pefley, R.K. (Santa Clara Univ., CA (USA)). 1984. Contract FG03-84CE50036. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013612.

Arguments are presented for a car of the future of standard size wth a small air-cooled 2-cycle methanol-fueled engine running at high rpm using half as much energy to produce current levels of comfort and performance. (MHR)

37914 **(DOE/NASA—0263-1) Development of carbon slurry fuels for transporation (hybrid fuels-Phase II).** Ryan, T.W. III; Dodge, L.G. (Southwest Research Inst., San Antonio, TX (USA)). May 1984. Contract AI01-81CS50006. 174p. (NASA-CR—174659; SWRI—6948). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015267.

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Slurry fuels of various forms of solids in diesel fuel were developed and evaluated for their relative potential as fuel for diesel engines. Thirteen test fuels with different solids concentrations were formulated using eight different materials. A variety of properties were examined including ash content, sulfur content, particle size distribution, and rheological properties. Attempts were made to determine the effects of these variations on these fuel properties on injection, atomization, and combustion processes. The injection and atomization characteristics (transient diesel sprays) of the test fuels were examined in a spray bomb in which a nitrogen atmosphere was maintained at high pressure and temperature, 4.2 MPa and 480°C, respectively. The diagnostics of the sprays included high-speed movies and high-resolution still photographs. The slurries were found to affect the global spray characteristics of penetration rate and cone angle and the particle-size distribution within the spray. In general, the drop size increased, the penetration rate increased and the cone angle decreased with the slurries as compared to a baseline diesel fuel. The slurries were also tested in a single-cylinder CLR engine in both direct-injection and prechamber configurations. The data included the normal performance parameters as well as heat release rates and emissions. In most cases, the slurries performed very much like the baseline fuel. The combustion data indicated that a large fraction (90% or more) of the solids were burning in the engine. It appears that the prechamber engine configuration is more tolerant of the slurries than the direct-injection configuration.

36 MATERIALS

REFER ALSO TO CITATION(S) 36000037874

37915 **(DOE/ER/05002—40) Structure and properties of grain boundaries. Progress report, 15 July 1983-14 July 1984.** Balluffi, R.W.; Bristowe, P.D. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). Mar 1984. Contract AC02-78ER05002. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014368.

Results were obtained in the following areas: determination of relative grain boundary energies by the rotating crystallite method; simple structural unit model for core-dependent properties of tilt boundaries; twist boundary energies for metals with long-ranged pairwise interatomic potentials; structural unit/grain boundary dislocation model for grain boundary structure; detection of expansion of boundaries using diffraction; effect of secondary relaxations on diffraction from high-Σ [001] twist boundaries; and mechanism of grain boundary migration.

37916 **(SERI/TR—255-2217) Materials characterization using ion, electron, and photon probes.** Czanderna, A.W. (Solar Energy Research Inst., Golden, CO (USA)). May 1984. Contract AC02-83CH10093. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84004518.

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The content of a lecture at the senior-graduate level on materials characterization using ion, electron, and ion probes is amplified and extensively referenced. The emphasis of the report is compositional surface analysis using secondary ion mass spectrometry (SIMS), ion scattering spectrometry (ISS), Rutherford backscattering spectrometry (RBS), x-ray photoelectron spectroscopy (XPS), and Auger electron spectroscopy (AES). The physical principles, experimental methods, advantages and limitations, and illustrative examples for each of the five methods are discussed. Composition in depth profiling using sputter ion etching is also described, including mechanisms, yields, rates, instrumentation, advantages, and limitations. Brief comments and literature citations are given for materials characterization using SIMS, ISS, RBS, AES, and XPS in corrosion, surface modification, surface segregration, thin films, and grain boundaries for various materials of interest in industrial materials science and engineering. Extensive references are provided as a guide for those desiring greater depth in the topical areas discussed.

37917 **DOE materials research programs pursuant to vulnerable materials.** Gottschall, R.J. (Dept. of Energy, Washington, DC). *Materials and Society;* 8: No. 2, 183-188(1984).

DOE-supported materials research is primarily concerned with the performance of materials and the limitations which their properties and behavior impose on fossil, fission, fusion, solar and geothermal energy conversion, and on conservation technologies. The author gives an overview of publications and assesments on DOE research programs at various laboratories. The scientific and technical reviews listed cover work related to the performance of materials, the development of characterization techniques, and the development of new materials andnew methods of materials preparation. 2 tables.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 36010037253, 37280, 37539, 37545, 37545, 37555, 37562, 37591, 37595, 37598, 37603, 37603, 37637, 37718, 38033, 38058

37918 **(AD-A—138123/5) Studies of coercive force of permanent magnet materials. Final report 1 Jan-31 Dec 83.** Wallace, W.E. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). 31 Jan 1984. 14p. NTIS, PC A02/MF A01.

Permanent magnets were prepared by sintering on-stoichiometry Sm2Co17 and Sm2Co17 doped with Fe,Mn,Zr and Hf. Coercive forces subscript i H subscript C were low, less than 1 kOe. Although doping increases anisotropy field, it does not enhance subscripti H subscript C except for Mn as dopant. In this case, doping increases subscript i H subscript C about two-fold. In these systems subscript i H subscript C seems to be nucleation-controlled. It is postulated that nucleation occurs at the oxidized surface where anisotropy is weak or negative. Surfaces were investigated by Auger spectroscopy with results consistent with the postulated mechanism. To test for effects of surface roughness, powders were washed with acid. No increase in subscript i H subscript C was observed. Samples ground under pentane and liquid nitrogen showed no significant difference in subscript i H subscript C. Oxygen content was about 3000 ppm by weight in the finished magnets. Results suggest that coercive force of the so-called 2-17 magnets (which are actually 2-phase mixtures of components with 1:5 and 2:17 stoichiometry, originates with the component having 1:5 stoichiometry.

37919 **(AERE-R—11155) Harwell research into the oxidation of metals: a summary.** Bavister, H.V. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Dec 1983. 26p. HMSO, London, price £4.00.

Materials divisions at Harwell have been involved in research into the oxidation of metals and alloys for a number of years. This report summarises the work which has been carried out on both applied and underlying programmes, identifies the links between the programmes, and makes suggestions for future lines of underlying research.

37920 **(BMFT-FB-T—84-030) Cladding of carbon steel with stainless steel.** Langhammer, H.J.; Jargon, F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751904.

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The process technology of producing stainless clad steels with carbon steel as base material and austenitic stainless steels as layer material could be developed to service stage by using the cast cladding method. The development of superferritic stainless clad steels with high corrosion resistance against sea-water and chlorine ions was carried out with clad steels of 17% Cr and 1% Mo and those of 28% Cr and 2% Mo. These steels were eminently resistant to pitting corrosion and stress corrosion cracking. The production of low alloyed stainless clad steels is carried out in our shops, whereas the cladding technology for superferritic stainless clad steels hasn't yet led to industrial application. The aim of the research and of the service tests to save raw materials and energy by new mating materials has been reached. The production of hollowwares, household appliances, tubes, exhaust units, silos etc. fabricated out of stainless clad steels has been sucessfully tested. For the

future the development of stainless clad steels has to be continued by testing methods with cheaper surface treatments and looking for new applications of these materials. The mode of operation to a continuous production of a surface treated tonnage steel is shown.

37921 **(CONF-840647—23-Draft) Response of ferritic steels to nonsteady loading at elevated temperatures.** Swindeman, R.W. (Oak Ridge National Lab., TN (USA)). 1 Apr 1984. Contract AC05-84OR21400. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014280.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

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High-temperature operating experience is lacking in pressure vessel materials that have strength levels above 586 MPa. Because of their tendency toward strain softening, we have been concerned about their behavior under nonsteady loading. Testing was undertaken to explore the extent of softening produced by monotonic and cyclic strains. The specific materials included bainitic 2 1/4Cr-1Mo steel, a micro-alloyed version of 2 1/4Cr-1Mo steel, a micro-alloyed version of 2 1/4Cr-1Mo steel containing vanadium, titanium, and boron, and a martensitic 9Cr-1Mo-V-Nb steel. Tests included tensile, creep, variable stress creep, relaxation, strain cycling, stress cycling, and non-isothermal creep ratchetting experiments. We found that these steels had very low uniform elongation and exhibited small strains to the onset of tertiary creep compared to annealed 2 1/4Cr-1Mo steel. Repeated relaxation test data also indicated a limited capacity for strain hardening. Reversal strains produced softening. The degree of softening increased with increased initial strength level. We concluded that the high strength bainitic and martensitic steels should perform well when used under conditions where severe cyclic operation does not occur.

37922 **(DOE/ER/10571—10) Radiation effects in amorphous metallic alloys. Final report.** Murray, R.B.; Onn, D.G.; Kramer, J.J. (Delaware Univ., Newark (USA)). Jun 1984. Contract AC02-80ER10571. 60p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84014302.

The alloys studied in this work were members of the series Fe/sub x/Ni/sub 80-x/P/sub y/B/sub 20-y/ ($20 \leqq x \leqq 40$; $0 \leqq y \leqq 14$). Alloys were prepared as ribbons on a melt spinner. Irradiations were performed with electrons, protons, deuterons and alpha particles at 0.25 to 2.25 MeV. Measurements were made of Curie temperature, small-angle x-ray scattering intensity, recrystallization kinetics, low-temperature electrical resistivity, magnetic domain structure, composition of the ribbon and near-surface region (by TEM, RHEED, and Auger studies), and surface profiles by Rutherford backscattering. Ion implantation effects are reported. Results show that the effects of irradiation with these light particles are very similar to those of thermal annealing, viz. structural relaxation to an amorphous state of lower energy than that achieved upon rapid freezing. Irradiation effects are interpreted qualitatively in terms of transient heating around the path of a projectile; direct atomic collisions apparently play a minor role.

37923 **(DOE/ER/10814—11) Zero-flux planes and flux reversals in multicomponent diffusion. Progress report, September 2, 1983-August 31, 1984.** Dayananda, M.A. (Purdue Univ., Lafayette, IN (USA). School of Materials Engineering). Aug 1984. Contract AC02-81ER10814. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015212.

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The principal area of research is interdiffusion in multicomponent alloys for the development of the zero-flux planes and flux reversals, diffusion paths and diffusion structures and analytical representation of ternary and quaternary diffusion paths. The systems under investigation are the ternary and quaternary systems: Cu-Ni-Zn, Fe-Ni-Cr, Cu-Ni-Zn-Mn and Ni-Co-Cr-Mo.

37924 **(DOE/ER/10870—152) Evidence for d-band conduction in metallic glasses containing transition metal elements.** Schulz, R.; Johnson, W.L. (California Inst. of Tech., Pasadena (USA). W.M. Keck Lab. of Engineering Materials). Jul 1984. Contract AT03-81ER10870. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014822.

A discussion is given of the electrical resistivity of amorphous transition metal glasses. Emphasis is based on three specific systems: ($Mo_{0.6}Ru_{0.4}$)/sub 1-x/B/sub x/, Zr/sub x/Ni/sub 1-x/ and Zr/sub x/Cu/sub 1-x/ on which large amounts of data, over a wide range of concentrations, can be found in the literature. These systems are characterized by strong scattering and have a conventional mean free path on the order of the interatomic spacing. In this limit the applicability of the Boltzmann formalism is doubtful. The relationship between the conductivity and the density of states at the Fermi level, coupled with the behavior of the electronic diffusivity across the concentration range, permits to distinguish regions where the d electrons seem to be the main carriers from other regions where the usual s free electrons are responsible for the transport.

37925 **(DOE/ER/10941—3) Environment-induced embrittlement: effect of impurity segregation and state of stress. Technical progress report, July 1, 1983-June 30, 1984.** Heldt, L.A.; Koss, D.A. (Michigan Technological Univ., Houghton (USA). Dept. of Metallurgical Engineering). 1984. Contract AC02-81ER10941. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015436.

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The program involves studies of both hydrogen embrittlement and stress corrosion cracking phenomena and consists of the following research projects: the influence of stress state on the hydrogen embrittlement of Ni sheet; hydrogen embrittlement of spheroidized plain carbon steel under multiaxial stress states; environmentally-assisted fracture under shear loading; studies of surface chemistry near the tips of stress corrosion cracks; stress corrosion of beta and alpha-beta brass; and effect of boundary misorientation on the hydrogen embrittlement of nickel bicrystals.

37926 **(DOE/ER/10972—T3) Influence of nitrogen on the sensitization, corrosion, mechanical, and microstructural properties of austenitic stainless steels. Technical progress report.** Clark, W.A.T. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Jul 1984. Contract AC02-81ER10972. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015134.

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In order to understand the mechanistic role of nitrogen and potential on the SCC of austenitic stainless steels in high temperature water, SSRT in 0.01 M NaCl solutions, at various applied potentials, at 250°C, and fractography using SEM were carried out in the present study on austenitic stainless steels with various nitrogen contents. The main results obtained in this study are summarized as follows: for all the steels tested an increase in the susceptibility to SCC is observed in the potential range -100 to 0 mV SHE; significant decreases in the elongation to failure and the change in the shape of the stress vs elongation curves just after reaching the maximum stress are indicators of an increased susceptibility to SCC in the potential range -100 to 0 mV SHE; a critical potential exists (-100 to 0 mV SHE) at which the elongation to failure ratio is a minimum; difference fracture morphologies were observed depending upon the applied potential. In general IGSCC was observed near the critical potential, TGSCC was observed at high potentials and ductile failure was observed at very high and very low potentials. Except at very low potentials a mixed mode of failure was observed; and near the critical potential secondary cracks were observed on the side surface of the SSRT specimens.

37927 **(DOE/ER/52110—T1) Radiation effects on structural materials. Technical progress report, January 1, 1984-June 30, 1984.** Ghoneim, N.M. (California Univ., Los Angeles (USA)). 1984. Contract FG03-84ER52110. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014771.

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By a generalization of an analysis due to Frank of the growing precipitate, we derive an analytic sink strength for the growing void that takes account of the void surface motion in a self-consistent fashion. The lower mobility of the vacancies compared to the interstitials ensures that a growing void captures more vacancies than the usual quasi-static void. The various consequences of this void bias for vacancies are discussed in relation to the swelling of reactor materials.

37928 **(DOE/ET/13513—T12) Study to optimize Cr-Mo steels to resist hydrogen and temper embrittlement. A study of carbides formed in low alloy Cr-Mo steels. Topical report No. 2.** Shaw, B.J. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 7 Feb 1984. Contract AC05-78ET13513. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015208.

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This paper discusses the role of composition on the carbides formed in low alloy Cr-Mo steels and also in the formation of proeutectoid ferrite. A method for the rapid evaluation of carbide type, using carbon extraction replicas on the scanning transmission electron microscope, is described in terms of a carbide compositional map.

37929 **(EPRI-CS—3504) Erosion-corrosion of metals and alloys at high temperatures.** Wright, I.G.; Nagarajan, V.; Merz, W.E. (Battelle Columbus Labs., OH (USA)). Jun 1984. 165p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920493.

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This project was undertaken to investigate the possibility of developing guidelines for the incorporation of erosion resistance into high-temperature alloys. An apparatus was developed to allow the laboratory study of erosion of a number of alloys over a range of conditions of erosion at temperatures up to 760°C (1400°F). The results of extensive studies showed that the conventional guideline of increasing hardness giving increasing wear resistance is not valid under conditions of high-temperature erosion-corrosion. The alloys which exhibited the lowest rates of material loss under the conditions used were soft and weak at temperature, but were highly oxidation resistant. There is a strong suggestion that the thermal oxide film or, more particularly, the high-temperature oxidation behavior of an alloy, plays a very important role in determining the response of an alloy to high-temperature erosion-corrosion. The erosion-corrosion rates of all the alloys were very strongly dependent on particle velocity; in the range of 19 to 52 m/s (63 to 170 fps) the maximum difference in rate of material loss for the range of alloys studied was a factor of about four. Erosion losses for alumina, and flyash from the combustion of pulverized coal or the fluidized-bed combustion of coal were essentially the same for velocities up to about 30 m/s (100 fps), further indicating that erosion losses resulted from impact removal of oxide scale rather than cutting removal of metal. Evaluation of available mathematical models of erosion revealed an ability to predict the order of merit ranking of alloys and a reasonable approximation of erosion rates, but little guidance for the design of alloys was provided.

37930 **(EUR—8501) Comparison of low-cycle fatigue data of 2 1/4 % CrMo steels.** Sanderson, S.J.; Petrequin, P.; Nieuwland, H.C.D.; Breuer, H.J. (Commission of the European Communities, Luxembourg). 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701517.

Data files have been produced on international strain-controlled fatigue information available for 2 1/4 %CrMo steels. The available data have been considered generally in terms of total strain range vs. cycles to failure (Nsub(f)), tensile stress at Nsub(f)/2 vs. cycles to failure and time to failure vs. cycles to failure. Where possible the continuous cycling data been statistically analysed in terms of the elastic and plastic strain components and cycles to failure to yield best-fit equations over defined temperature (T) regime viz: $T <= 427°C$, $427°C < T <= 550°C$ and $550°C < T <= 600°C$. Increasing test temperatures result in a progressive decrease in continuous cycling fatigue endurance and sustainable stress range.

37931 **(HEDL-SA—3031-FP) Evaluation of ferritic alloy Fe-2 1/4Cr-1Mo after neutron irradiation: irradiation creep and swelling.** Gelles, D.S.; Puigh, R.J. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1984. Contract AC06-76FF02170. 33p. (CONF-840604—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014647.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

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Irradiation creep and swelling measurements are reported for Fe-2 1/4Cr-1Mo after irradiation by fast neutrons over the temperature range 370 to 570°C. Diameter change measurements on thin walled pressurized tubes in a bainitic condition and density change measurements on rods in a nonstandard condition were made following irradiation in the Experimental Breeder Reactor II. The irradiation creep specimens were irradiated to a fluence of 5.7×10^{22} n/cm² ($E > 0.1$ MeV) or 30 dpa and the swelling specimens were irradiated to a peak fluence of 2.4×10^{23} n/cm² or 115 dpa. These results have been used as a basis to establish in-reactor creep and swelling correlations for 2 1/4Cr-1Mo in a bainitic condition. The correlations predict moderate swelling and moderate irradiation enhanced creep at 390°C to 480°C. The in-reactor creep data at 570°C indicates that thermal creep mechanisms become important at this irradiation temperature.

37932 (INIS-SU—211, pp 20-23) **Change of the Nb_3Sn stoichiometric composition at irradiation by protons and neutrons with energy up to 15 MeV.** L'vov, A.N.; Sidorenko, I.S.; Shilyaev, B.A. 1982. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780255.

In Technique of physical experiment.

Concentrations of elements occurring in transmutation reactions during Nb, Sn and Nb_3Sn irradiation with protons with the energy up to 15 MeV for fluences $10^{19}...10^{25}$ particles/cm², are calculated. Results are compared with analogous values obtained for 14 MeV neutrons and neutrons of the spectrum of BOR-60 reactor. It is shown that the assortment and concentrations of appearing elements depend on the elementary and isotopic composition of irradiated material, the sort of irradiating particles, and their energy spectrum. The results prove that protons bring about a more considerable change of stoichiometric composition of irradiated materials than neutrons. The calculation do not take into account secondary reactions and decay of non-stable reaction products.

37933 (INIS-SU—212, pp 9-12) **Improvement of vacuum conditions for electron beam melting of metals.** Azhazha, V.N.; V'yugov, P.N.; GUmenyuk, V.S.; Lavrinenko, S.D. 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780224.

In General and nuclear physics.

Characteristics of the device for electron-beam melting for pumping-out the chamber by steam-oil, getter-ion and titanium sublimation pumps are given. The specta of pesidual gases of the device are given. The application of the combination system of pumping-out in the case of mutual ope-- ration of getter-ion and titanium sublimation pump permits to obtain the limiting pressure in the chamber before melting 2.3×10^{-9} Hg. Melting of niobium of the NbSh make is performed. After two-fold electron-beam remelting the hardness of the metal reduces up to 41.0 kg/mm², the content of admixtures of the introduction is the following: oxygen-0.003, nitrogen-0.0009, carbon-0.003, hydrogen-0.008 mass%. It is shown that intensive gas discharge stops in the case of the secondary remelting after five-six minutes of exposure in the melted state.

37934 (INIS-SU—236, pp 196-199) **Positron annihilation, irradiated with high energy γ-quantum.** Dekhtyar, M.I.; Sedov, Yu.A.; Fedchenko, R.G. (AN Ukrainskoj SSR, Kiev. Inst. Metallografii; Kievskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The radiation-induced defects in cobalt irradiated by slowing-down radiation beam from betatron having maximal γ-quantum energy of 50 MeV and approximately 3×10^6 R dose were studied by the positron annihilation method. Vacancy-type defects are found to be the trapping centres for positrons in irradiated cobalt.

37935 (INIS-SU—236, pp 191-195) **Application of positron annihilation technique for powder metallic materials study.** Artemova, M.V.; Gruzin, P.L.; Klopikov, E.B.; Novikov, V.I.; Relushko, P.F.; Semenikhin, A.N.; Svirida, S.V. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Volume and surface electron density of ultrafine particles of nickel with the mean diameter 500 A was investigated by means of positron lifetime spectroscopy. Defect and surface capture rates were calculated basing on capture model. It was found that surface electron density variates unmonotonously with increase of pressure. Baking leads to the void formation in the samples.

37936 **(IS-RIC-PR—7) Critical evaluation of binary rare earth phase diagrams. Progress report, June 1-November 30, 1983.** Gschneidner, K.A. Jr.; Calderwood, F.W. (Iowa State Univ. of Science and Technology, Ames (USA). Rare-Earth Information Center). Dec 1983. Contract W-7405-ENG-82. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015057.

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This report covers rare earth-gold, rare earth-barium, and rare earth-beryllium alloy systems. (DLC)

37937 **(IS-RIC-PR—8) Critical evaluation of binary rare earth phase diagrams. Progress report, December 1, 1983-February 29, 1984.** Gschneidner, K.A. Jr.; Calderwood, F.W. (Iowa State Univ. of Science and Technology, Ames (USA). Rare-Earth Information Center). Mar 1984. Contract W-7405-ENG-82. 101p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84014880.

This report covers rare earth-bismuth alloy systems. (DLC)

37938 **(KLR—81-48-C) Resistance to crack growth under the conditions of fatigue, creep, and corrosion.** Hoffelner, W.; Speidel, M.O. (Brown, Boveri und Co. Ltd., Baden (Switzerland). Research Center). Mar 1981. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751908.

Portions are illegible in microfiche products.

Fatigue and creep properties of various superalloys for gas turbine applications were studied with methods of fracture mechanics. Three different groups of materials were investigated at various temperatures: blade alloys, casing alloys and rotor alloys. In case of blade alloys crack branching plays an important role in understanding the fatigue crack propagation behaviour. For these cast alloys it was also possible to calculate the endurance limit of smooth samples from the fatigue threshold stress intensity range treating casting pores as sharp defects. Only slight differences in fatigue crack growth rates of different casing and rotor alloys were found.

37939 **(LBL—17442) Advanced metal alloys for energy needs.** Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 29p. (CONF-840570—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014585.

From Materials for future energy systems conference; Washington, DC, USA (1 May 1984).

Portions are illegible in microfiche products.

Advanced energy technologies create a range of needs for new metal alloys that have exceptional properties that are specifically tailored to the engineering needs of particular systems. To meet these needs in a timely and economical way it has been necessry for the metallurgical community to develop and adopt techniques for systematic alloy design. Those techniques are described and illustrated with three specific examples: (1) the development of new cryogenic structural steels for the case and support structure of high field superconducting magnets; (2) the development of Al-Li alloys for fuel savings in aircraft; (3) the development of formable sheet steels for use in the automotive industry.

37940 **(NIIAR—23(588)) Nickel effect on structure and radiation resistance of welded joints in WWER-1000 reactor vessel.** Vishkarev, O.M.; Zubchenko, A.S.; Krichevets, T.M.; Kolesova, T.N.; Malinovskij, V.K.; Nosov, S.I.; Pecherin, A.M.; Shamardin, V.K. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701519.

The effect of nickel content (1.3-1.9%) on the radiation resistance and structure of the 15Kh2NMFAA steel welded joints manufactured from the SV-10KhGNMAA wire with the FTs-16 flux has been studied. As a results of the experiments performed the conclusion has been drawn that the increase in nickel content within certain limits leads to refining of the welded joints structure, their radiation resistance do not change.

37941 **(NIIAR—28(543)) Mechanical properties and corrosion of zirconium alloys under irradiation in superheated steam.** Shamardin, V.K.; Maershina, G.I.; Andreeva, A.B. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701520.

Investigation results of mechanical properties and corrosion of zirconium alloys of intermetallide type and alloys, containing niobium, after irradiation to fluences of $1.9x10^{20}$, $3.3x10^{20}$ and $5.2x10^{20}$ neutr/cm^2 for 900, , 1800, 2800 hrs respectively in superheated steam at temperatures 630-840 K are presentes. It is shown that neutron irradiation intensifies corrosion of intermetallide type alloys by a factor of 1.5-2 and practically does not change their mechanical properties. Corrosion of alloys, containing 1%Nb, proceeds with the formation of thick oxide films up to 350 μm, mass content of hydrogen in them reaching 0.04-0.1%. Due to intensified corrosion samples of the alloys manifested brittle fracture during tensile fracture. The alloy Zr+2.5%Nb under conditions of irradiation in the medium of superheated steam showed the properties similar to the alloys of intermetallide group.

37942 **(UCRL—53174-2) Plutonium microstructures. Part 2. Binary and ternary alloys.** Cramer, E.M.; Bergin, J.B. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48;W-7405-ENG-36. 172p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84015556.

This report is the second of three parts that exhibit illustrations of inclusions in plutonium metal from inherent and tramp impurities, of intermetallic and nonmetallic constituents from alloy additions, and of the effects of thermal and mechanical treatments. This part includes illustrations of the microstructures in binary cast alloys and a few selected ternary alloys that result from measured additions of diluent elements, and of the microconstituents that are characteristic of phase fields in extended alloy systems. Microhardness data are given and the etchant used in the preparation of each sample is described.

37943 **Magnetic properties of amorphous thin films produced by ion mixing.** Van Rossum, M.; Nicolet, M.; Wilts, C.H. (California Institute of Technology, Pasadena, California 91125). *Journal of Applied Physics;* **56**: No. 4, 1032-1035(15 Aug 1984).

We have produced several magnetic amorphous alloys by ion mixing of thin multilayer films. Our results show that the ion mixing technique is able to produce amorphous films of the various categories (transition metal-metalloid, transition metal pairs) at the composition appropriate for the appearance of magnetic ordering. A comparison of their saturation magnetization with that of related vapor quenched films suggests similar nearest-neighbor coordination in both kinds of samples.

37944 **Microstructural observations of sputtered silicon-tin-hydrogen alloys.** Jones, K.M.; Williamson, D.L.; Yacobi, B.G. (Solar Energy Research Institute, Golden, Colorado 80401). *Journal of Applied Physics;* **56**: No. 4, 1220-1223(15 Aug 1984). Contract AC02-77CH00178.

Structural and compositional properties of hydrogenated silicon-tin alloys have been investigated as a function of tin content, sputtering pressure, and presence of hydrogen. Transmission electron microscopy, energy dispersive x-ray microanalysis, and scanning electron microscopy were used to detect compositional and structural inhomogeneities in these materials.

37945 **Work function of sputter-formed Re-1%Mo.** Gordon, R.L. (Pacific Northwest Laboratory, Richland, Washington 99352). *Journal of Applied Physics;* **56**: No. 3, 810-813(1 Aug 1984).

Thermally induced changes in work function and surface composition of a sputter-formed Re-1%Mo alloy have been measured. Segregation of Mo to the alloy surface was accompanied by a decrease in surface work function. The relationship between surface composition and work function change fits the Topping model of dipole layer formation with dipoles being formed by electron transfer from Mo to Re. Values for the dipole moment at zero field and the polarizability of Mo on the surface of Re were found to be (5.27 +- 0.36) x 10^{-30} C m and (74.1 +- 10.1) A^3, respectively. The direction of charge transfer is consistent with published electronegativity values for Mo and Re, but its magnitude of 0.126 electrons per atom was significantly smaller than the charge transfer in the bulk expected upon alloy formation.

37946 **Critical current and upper critical field of multifilament Nb/sub 3-x/Ta/sub x/Sn superconductor.** Schwall, R.E.; Ozeryansky, G.M.; Foner, S.; McNiff, E.J. Jr. (Intermagnetics General Corporation, Charles Industrial Park, Guilderland, New York 12084). *Journal of Applied Physics;* **56**: No. 3, 814-818(1 Aug 1984).

Superconductive wires containing 78 filaments of Nb/sub 3-x/Ta/sub x/Sn for 4—16 at. % Ta were produced using the external bronze process to yield a composite with an overall composition 21.4 wt. % Nb—Ta, 64.9 wt. % Cu, and 13.6 wt. % Sn. Reaction periods of 20 to 260 h at temperatures from 650 to 735 °C were used. Critical-current densities over the entire wire cross section were 5 x 10^4 A/cm^2 at 14 T and 1 x 10^4 at 19.7 T, the measured H/sub c/2 was 27 T at 4.2 K for wires with 8 μm filaments containing approximately 4 at. % Ta. Single filament wires using a 13 wt. % bronze matrix were fabricated to determine the effect of Ta on reaction kinetics. The A15 layer thickness was approximately proportional to the square root of the reaction time and independent of tantalum concentration. The critical-current densities are discussed in terms of A15 grain structure, stoichiometry, filament uniformity, and H/sub c/2 enhancement.

37947 **Stresses and elastic constants of metals with classical ion motion.** Wallace, D.C.; Schiferl, S.K.; Straub, G.K. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *A: General Physics;* **30**: No. 1, 616-619(Jul 1984).

For a metallic system of ions with interaction potentials of the general form given by pseudopotential theory, and with the motion of the ions treated by classical statistics, strain derivatives of the canonical partition function are constructed. Expressions are obtained for the stresses and isothermal elastic constants, for any crystal in which there are no sublattice displacements accompanying a homogeneous deformation. These expressions are in the form of canonical-ensemble averages, and can be evaluated by standard computer simulation techniques. The nature and magnitude of quantum corrections are discussed.

37948 **Violet and Borg respond.** Violet, C.E.; Borg, R.J. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **52**: No. 23, 2098-2099(4 Jun 1984). Contract W-7405-ENG-48.

A reply to the comments on the metastable phase separation in Au-Fe alloys is presented. (AIP)

37949 **Ultraviolet-photoemission and electron-energy-loss spectroscopic studies of ^{99}Tc.** Chen, T.; Wolf, E.L.; Giorgi, A.L. (Ames LaboratoryU.S. Department of Energy, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *B: Condensed Matter;* **29**: No. 11, 6036-6042(1 Jun 1984). Contract W-7405-ENG-82.

Angle-integrated ultraviolet-photoemission and reflection electron-energy-loss spectra have been obtained for ^{99}Tc for the first time. The photoemission energy distribution curves are in semiquantitative agreement with the calculated density of states. The work function of this material was found to be 5.0 +- 0.5 eV. The volume and surface plasmons are at 25.0 +- 0.5 and 20.7 +- 0.5 eV, respectively. A lower plasma oscillation is observed at 9.5 +- 0.5 eV. N/sub I/ and N/sub II,III/ ionization energies obtained are in good agreement with x-ray measurements. Comparisons of ^{99}Tc properties to those of other transition metals in period 5 are also given.

37950 **Double ferromagnetism in single-crystal Gd-Y-Lu alloys.** Ito, T.; Oka, M.; Legvold, S.; Beaudry, B.J. (Department of Physics, Shimane University, Matsue-shi, Shimane-ken 690, Japan). *Physical Review* [*Section*] *B: Condensed Matter;* **29**: No. 11, 6276-6279(1 Jun 1984). Contract W-7405-ENG-82.

Magnetization, electrical resistivity, specific-heat and thermal-expansion measurements have been made on Gd-Y-Lu single crystals. Low isofield magnetization data for the a-axis sample of Gd_{75}Y/sub 17.5/ Lu/sub 7.5/ exhibit two different Curie-Weiss regimes, which suggests double ferromagnetism. Electrical resistivity, specific-heat, and thermal-expansion data show two anomalies at the transition temperatures. The anomaly at 231.5 K shows a λ-type second-order phase transition and the anomaly at 223 K shows a sharp spike first-order phase transition.

37951 **High-energy spectroscopic study of the electronic structure of UBe_{13}.** Wuilloud, E.; Baer, Y.; Ott, H.R.; Fisk, Z.; Smith, J.L. (Institut de Physique, Universite de Neuchtel, Rue A.-L. Breguet 1, CH-2000 Neuchtel, Switzerland). *Physical Review* [*Section*] *B: Condensed Matter;* **29**: No. 9, 5228-5231(1 May 1984).

X-ray photoemission and bremsstrahlung isochromat spectroscopies have been used to probe the occupied and unoccupied states of UBe_{13}. Between two and three electrons are found to populate the tail of a surprisingly broad 5f band (~5 eV) of extended states. With our resolution (< or ≈0.5 eV) it is not possible to observe directly at the Fermi energy any peculiarity of the density of states explaining the extraordinary properties of this compound. However, the drastic differences between the core-level spectra of U and Be indicate that the 5f states remain essentially confined around the U atoms and are only weakly hybridized with the sp-band states originating from the Be atoms.

37952 **Microstructure and critical current characteristic of a bronze-processed multifilamentary Nb_3Sn superconducting wire.** Wu, I.W.; Dietderich, D.R.; Holthuis, J.T.; Hong, M.; Hassenzahl, W.V.; Morris, J.W. Jr. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **54**: No. 12, 7139-7152(Dec 1983). Contract AC03-76SF00098.

The superconducting phase within a bronze-process, multifilamentary Nb_3Sn superconducting wire is formed by reaction at the interface between the Nb filaments and the bronze matrix. The maximum current that can be carried by the wire is known to depend on the time and temperature of the heat treatment as well as on the transverse magnetic field. In the work reported here a commercial Airco wire containing 2869 Nb filaments of 3—5 μm diameter in a matrix with a bronze/Nb ratio of three was given a variety of reaction heat treatments. The microstructure of the reacted layer was analyzed as a function of heat treatment, and found to be divisible into three concentric shells that are morphologically distinct. The central shell consists of fine equiaxed grains. Its areal fraction, grain size, and composition depend on the heat treatment, and appear to determine the critical current. The best combination of grain size and composition, and the highest critical current, is obtained with an intermediate reaction temperature (700—730 °C). A further improvement in both microstructure and critical current is achieved by double-aging the wire, starting the reaction at 700 °C and finishing it at 730 °C. The relation between microstructure and heat treatment is interpreted in light of the apparent mechanism of the reaction, which is revealed by high resolution analyses of the reacted layer. The relation between microstructure and properties

is consistent with current understanding of the influence of grain size and stoichiometry on the behavior of type II superconductors.

37953 **Cation self-diffusion in Cr_2O_3.** Hoshino, K.; Peterson, N.L. (Argonne National Lab., IL). *Journal of the American Chemical Society;* **66**: No. 11, C202-C203(Nov 1983). Contract W-31-109-ENG-38.

Self-diffusion of ^{51}Cr was measured both parallel to and perpendicular to the c axis in single crystals of Cr_2O_3 as a function of oxygen partial pressure at 1490° and 1570°C. The oxygen-partial-pressure dependence of the diffusivity indicates that cation self-diffusion occurs by a vacancy mechanism. The values of the self-diffusion coefficients determined in this experiment are about 10^4 times smaller than those previously reported in this temperature range. 10 references, 3 figures, 1 table.

37954 **Hydrogen diffusion in aluminum.** Mclellan, R.B. (Rice Univ., Houston, TX). *Scripta Metallurgica;* **17**: 1237-1240(Oct 1983).

Recent findings on the H-Al system are discussed in terms of the kinetic behavior predicted for solutions of H in metals where there is a high concentration of vacancies in thermal equilibrium. Solubility and diffusivity plots for H in Al are presented together with the corresponding equations. An analysis of the results obtained suggests that direct thermodynamic measurement of the i-vacancy binding energy may be possible through equilibrating with a second phase where the chemical potential of i is such that all the vacancy-related sites are occupied.

37955 **Influence of nonsteady state behavior on superplastic deformation of a 25.7 Cr-6.6 Ni stainless steel.** Kashyap, B.P.; Mukherjee, A.K. (Division of Materials Science, Department of Mechanical Engineering, University of California, Davis, CA 95616). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 9, 1875-1881(Sep 1983).

Superplastic behavior of a microduplex stainless steel (IN744) was studied by deforming specimens with initially elongated grains. As a result of deformation, grain growth and breaking up of elongated grains were noticed to occur concurrently. These microstructural instabilities result in strain hardening or strain softening, respectively. This then leads to nonuniqueness in the flow behavior. Some examples of nonuniqueness in stress-strain rate relation include the presence of: strength anisotropy, increase in strain rate sensitivity, constant stress level for varying grain size, and two distinct stress-strain rate curves over comparable test condition for the same initial microstructure. These have been explained by the concomitant microstructural changes and the influence of such changes on instantaneous flow stress. Emphasis is made on the need to eliminate microstructural instability in order to characterize the deformation phenomena under steady state.

37956 **Influence of composition and substrate bias on structure and inert gas content of sputter-deposited Ni-La alloys.** Knoll, R.W.; McClanahan, E.D. (Pacific Northwest Lab., Richland, WA). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **1**: No. 2, 271-274(Apr-Jun 1983). Contract AC06-76RL01830.

High concentrations of inert gases can be incorporated into the structure of certain bias-sputtered rare earth/transition metal alloys, and these materials are useful as stable reservoirs of inert gas. Ni-La alloys containing a composition gradient ranging from about 0.3 to 30 at.% La have been deposited at several bias voltages, in a dc triode system, with cylindrical target-substrate geometry, using an asymmetric composite target, and a Kr discharge. The dependence of Kr content and alloy structure on composition (La/Ni atom ratio) and substrate bias has been determined systematically. Deposit structure was examined by x-ray diffraction, and Kr content was measured by energy dispersive x-ray spectroscopy and by vacuum fusion. At constant bias, Kr content initially increases rapidly with La/Ni, then saturates. As La/Ni ratio increases, alloy structure changes from fully crystalline to fully amorphous. Bias has a pronounced effect on preferred orientation and on relative fraction of crystalline phase. The work is discussed in terms of previous studies of sputter-deposited RE/TM alloys and amorphous metals.

37957 **Trapping of interstitials in metals.** Wert, C.A.; Frank, R.C. (Univ. of Illinois, Urbana). *Annual Review of Materials Science;* **13**: 139-172(1983). Contract AC02-76ER01198.

The term trapping is used extensively to refer to the fact that interstitial atoms often find interstices associated with lattice imperfections to be energetically preferable to normal sites. This preference results in a delay of diffusion of interstitial atoms near these sites. As understanding of the details of lattice imperfections has improved, understanding of the effect of traps on the diffusion process has increased. Trapping is often illustrated by the use of a potential energy diagram. This simple model is characterized by a potential energy well deeper than those of surrounding interstitial sites. The energy required for the interstitial to jump into the trap is the same as that required for jumping into other adjacent interstitial sites, but that required for jumping out is greater. The additional energy required to leave the site is often designated as the trap binding energy, E/sub B/. Potential energy diagrams appropriate for most traps in metals are likely to be more complicated, but this simple model is a starting point for more sophisticated models of trapping. Imperfections may occasionally produce interstitial sites less favorable than normal sites and thus be less preferred. Little experimental exploration of this anti-trapping phenomenon has been carried out, however. Developments in understanding at various levels of trapping of interstitial impurities by lattice imperfections are examined.

37958 **Microstructures in 0.1 to 1 Mbar shock-loaded 200 nickel: a TEM study.** Staudhammer, K.P.; Johnson, K.A.; Olinger, B.W. (Los Alamos National Lab., NM). *Electron (London);* 272-273(1983).

Flyer plate techniques have been used to obtain tensile compression shocks. In the present work 200 nickel was subjected to a radial shock profile which varied in pressure from 0.1 to 1 Mbar along the axis of a cylinder. This unique shock profile produced tensile strains of up to 30% elongation at a strain rate of 10^6/sec. The nickel cylinder had an initial grain size of 60 μm. Post shock optical microscopy revealed minimum deformation in the bulk of the assembly. However, at the shock convergence axis of the cylinder fracture/spalation was observed, particularly at the higher pressures. The hardness measurements revealed a significant increase in hardness over that of the annealed material, 240 vs 100 dph. The uniformly high value of microhardness indicated a saturation of defects and magnetic permeability indicated much the same, with no significant variation throughout the bar. The only significant change in hardness was at the bottom where either heating, delamination and/or, mach-stem effects dropped the dph values closer to the annealed value.

37959 **Study of charge transfer in FeTi.** Taftoe, J. (Brookhaven National Lab., Upton, NY). *Electron (London);* **41**: 296-297(1983). Contract AC02-76CH00016.

It is well known that for reflections corresponding to large interplanar spacings (i.e., sin theta/λ small), the electron scattering amplitude, f, is sensitive to the ionicity and to the charge distribution around the atoms. This was used in order to obtain information about the charge distribution in FeTi, which is a candidate for storage of hydrogen. The goal is to study the changes in electron distribution in the presence of hydrogen, and also the ionicity of hydrogen in metals, but so far the study has been limited to pure FeTi. FeTi has the CsCl structure and thus Fe and Ti scatter with a phase difference of pi into the 100-reflections. In order to determine the numerical value of F_{100}, convergent beam diffraction patterns and dark field thickness fringes were studied with the 100-reflection at the Bragg reflecting position. Preliminary results indicate that F_{100} is about 7 times larger than the value obtained from the tabulated values of the scattering amplitudes.

37960 **Temperature dependence of the electric field gradient in Er metal.** Rafailovich, M.H.; Kistner, O.C.; Dafni, E.; Sunyar, A.W.; Mohsen, M.; Vajda, S.; Sprouse, G.D. (Brookhaven National Lab., Upton, NY). *Hyperfine Interactions;* **15-16**: 283-288(1983).

The method of perturbed angular distributions was used to measure the temperature dependence of the electric field gradient

in Er single crystal for 98 K ≦ T ≦ 456 K. The Iπ = 11$^-$ isomer in ^{154}Er was used as a probe. Ω_0 increases monotonically for 98 K ≦ T ≦ 456 K. The I/sup π? = 11^1 isomer in ^{154}Er was used as a probe. ω_0 increases monotonically for 98 K ≦ T ≦ 259 K and then decreases. A possible cause for this effect may be short range interactions between the f electrons above the Neel point.

37961 **On-line measurement of foil thickness from convergent beam electron diffraction patterns.** Bentley, J.; Lehman, G.L. Oak Ridge, TN; Oak Ridge National Laboratory (1982). 2p. (CONF-820806—).

From 40. Electron Microscopy Society of America annual meeting; Washington, DC, USA (9 Aug 1982).

Three data acquisition methods for the determination of foil thickness from CBED (convergent beam electron diffraction) patterns are in use at ORNL (Oak Ridge National Laboratory). All employ the same FORTRAN programs for analysis and make use of a computer graphics terminal to display the results. The first method simply uses data input from conventional film-recorded CBED pattern. The other two methods are on-line and are capable of providing a rapid (<1 min) determination of foil thickness. In the most rapid and convenient method the post-specimen deflection coils of a Philips EM400T equipped with a field emission gun (FEG) are adjusted to bring the desired points of the CBED pattern to a reference point on the viewing screen. The positions required to define the Bragg angle, theta /sub B/, and intensity maxima and minima are shown. THe excitation of the post-specimen deflection coils is monitored by a 12-bit AD11-K analog-to-digital converter (ADC) of a PDP-11/34 computer. A short MACRO program provides the desired coordinates for geometrical manipulation and use in the main FORTRAN program. 3 figures.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 36020037824, 37875, 37905, 38073

37962 **(AERE-MPD/NBS—245) Observation of oxygen Frenkel disorder in uranium dioxide above 2000 K using neutron scattering techniques.** Clausen, K.; Hayes, W.; Macdonald, J.E.; Osborn, R.; Hutchings, M.T. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Dec 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702561.

Diffraction and coherent diffuse quasielastic scattering of neutrons have been used to investigate Frenkel disorder of the oxygen sublattice in single crystals of stoichiometric UO_2. Measurements were made up to 2900 K using a special high-temperature furnace. The results provide the first direct evidence for the occurrence of Frenkel disorder in UO_2 and enable estimates of the defect concentration and activation energy to be made.

37963 **(DOE/ER/10438—8) Critical conditions for the growth of SiC, Si_3N_4, and SiO_2. Final report.** Smith, F.W. (City Coll., New York (USA). Dept. of Physics). May 1984. Contract AC02-79ER10438. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014824.

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Previous results obtained in a HV system have been confirmed under UHV conditions. Results for the interaction of O_2 with Si are consistent with a model focusing on the kinetics of SiO_2 cluster growth and the thermodynamics of the competing etching reaction leading to production of the volatile SiO molecule. The initial growth of SiO_2 on heavily phosphorus-doped Si occurs for lower values of $P(O_2)$ than on intrinsic Si. Interaction of H_2O with Si leading to the growth of SiO_2 can be understood in terms of a thermodynamic model modified to include effects due to H_2O dissociation and SiO desorption. The interaction of NO with Si at high T, leading to the formation of silicon nitride at high NO pressures, has 100% probability for the occurrence of the reaction NO + Si → N + SiO, per incident NO molecule.

37964 **(DOE/ER/45006—1) Fundamental studies of structure property relationship in transformation toughened ceramics. Final report.** Heuer, A.H. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Metallurgy and Materials Science). 15 May 1984. Contract AC02-83ER45006. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015344.

Research was performed in three areas: Ostwald ripening in ZrO_2-toughened Al_2O_3 (ZTA), plastic deformation in stabilized ZrO_2 single crystals, and stress-induced phase transformations in Y_2O_3-containing tetragonal ZrO_2 polycrystals (Y-TZP).

37965 **(IS—4850) Review of electrical conductivity studies in pure HfO_2, binary systems containing HfO_2, and other multicomponent systems containing HfO_2(ZrO_2).** Jordan, G.W.; Berard, M.F. (Ames Lab., IA (USA)). 1 Mar 1984. Contract W-7405-ENG-82. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015060.

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Electrical conductivity investigations of pure HfO_2, binary systems containing HfO_2, and ternary and quaternary systems containing HfO_2 or ZrO_2 were surveyed up to early 1984. These systems have not previously been comprehensively reviewed. One hundred and twelve references are cited.

37966 **(Juel—1873) Development of reaction-bonded silicon carbide(SiSiC)-ceramics.** Gyarmati, E.; Gupta, A.K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Oct 1983. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751933.

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The present study initially deals with various methods of SiC production. In particular, the method for producing reaction-bonded silicon carbide (SiSiC) is described. Connections are derived and discussed between the different densities of the preliminary and final products. Green bodies were fabricated according to three types of ingredients showing clear differences mainly in bending strength at room temperature after siliconizing by the immersion method. With the most favourable production parameter anti sigmasub(B) = 336 MPa and anti rhosub(B) = 3.01 g/cm^3 was found; however, peak values of up to sigma = 422 MPa and rho = 3.10 g/cm^3 were achieved. The measured property values were correlated and interpreted with the aid of stereometrically quantified phases.

37967 **(LA-UR—84-1794) Influence of 5f electrons on structure and bonding in the actinide-hydrogen intermetallics.** Ward, J.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 14p. (CONF-8409102—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013893.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

Complexa phases form for the Th + H and U + H systems that are found with no other metals. In the Pa + H system, simple bcc C15 Laves and A15 phases can form, dependent on temperature and composition. The phase transformations appear to b magnetically driven, as a resutl of the decoupling of the metallic 5f electron bonding that occurs during hydriding; the C15 phases contain two kinds of Pa atoms-the one sublattice being still fully f-bonded and the other magnetic. This is a unique situation in solid state physics which defies a valence description. A similar situation obtains for A15 β - UH_3 structure. The parent metals themselves exhibit electronegativities not unlike those of the mid-3d transition metals (e.g., Fe) because the valence electrons re tied up in metallic bonding. However, under the driving force for hydriding, the lattices can open up, decoupling the f-bonding and inducing magnetism. The systems then aggressively form very stable hydrides typical of highly-electropositive metals. Beyond uranium the trivalent metallic state is favored and rare-earth-like hydrides are found for Np + H and Pu + H. Nevertheless, the solid-state and transport properties are markedly different than for the rare-earth hydrides, showing that the latent influence of the 5f electrons is still strong.

37968 **Anomalous perturbed magnesium vacancy in nickel-doped MgO.** Boldu, J.L.; Muoz Picone, E.; Chen, Y.; Abraham, M.M. (Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Apartado Postal 20-364, 01000 Mexico, Distrito Federal, Mexico). *Physical Review [Section] B: Condensed Matter;* **29**: No. 11, 6365-6366(1 Jun 1984). Contract W-7405-ENG-26.

An anomalous perturbed magnesium vacancy in MgO, which shares some characteristics of the V^- and V/sub Al/ defects but belongs to neither category completely, is reported.

37969 **X-ray diffraction study of the cubic-to-tetragonal structural transformation in substoichiometric lanthanum trihydride and trideuteride.** Klavins, P.; Shelton, R.N.; Barnes, R.G.; Beaudry, B.J. (Ames Laboratory, U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **29**: No. 10, 5349-5353(15 May 1984). Contract W-7405-ENG-82.

A low-temperature powder x-ray diffraction study of 13 compounds in the series LaH/sub x/ and LaD/sub x/ (2.50< or =x< or =3.00) indicates the presence of a cubic-to-tetragonal distortion of the lanthanum sublattice for a limited concentration range centered about x = 2.75. Transformation temperatures occur from 197 to 256 K, with a maximum distortion from cubic symmetry of about 1%. Possible influence on the metal sublattice from the hydrogen (deuterium) sublattices is considered. Precision room-temperature lattice parameters are also reported for 22 samples in the extended series LaH/sub x/ and LaD/sub x/ (2.00< or =x< or =3.00).

37970 **Synthesis and solid state studies on $Mn_2Sb_2O_7$ and (Mn/sub 1-x/Cd/sub x/)$_2Sb_2O_7$ pyrochlores.** Subramanian, M.A.; Clearfield, A.; Umarji, A.M.; Shenoy, G.K.; Subba Rao, G.V. (Texas A & M Univ., College Station). *Journal of Solid State Chemistry;* **52**: No. 2, 124-129(Apr 1984).

Pyrochlore oxides of the type $Mn_2Sb_2O_7$ and (Mn$_2$/sub 1-x/Cd/sub x/)$_2Sb_2O^7$ have been synthesized by high-temperature solid state reactions and characterized by X-ray diffraction and chemical analysis. X-ray diffraction studies showed that the compound $Mn_2Sb_2O_7$ has a rhombohedrally distorted pyrochlore structure. In the solid solution (Mn/sub 1-x/Cd/sub x/)$_2Sb_2O_7$, the phases with x $\geqq$ 0.6 are cubic. Magnetic and ^{121}Sb Moessbauer studies indicate that all the Mn and Sb are present in the +2 and +5 state occupying A and B sites, respectively, in the pyrochlore structure. Electrical measurements indicate that the compounds are insulators or semiconductors exhibiting p-type behavior. The stoichiometry and probable cause of the rhombohedral distortion in $Mn_2Sb_2O_7$ and solid solutions are discussed.

37971 **X-ray diffraction and nuclear magnetic resonance studies of the relationship between electronic structure and the tetragonal distortion in ZrH/sub x/.** Cantrell, J.S.; Bowman, R.C. Jr.; Sullenger, D.B. (Miami Univ., Oxford, OH). *Journal of Physical Chemistry;* **88**: No. 5, 918-923(1 Mar 1984). Contract AC04-76DP00053.

Low-temperature (LT) X-ray diffraction (XRD) studies of 13 ZrH/sub x/ samples in the range 1.50 $\leqq$ x $\leqq$ 2.00 were made by using a Guinier-Simon (GS) focusing camera and other methods. The ZrH/sub x/ phase diagram was made more complete for the fcc (δ-phase) and fct (epsilon-phase) regions from ambient to low temperature (i.e., to about 110 K). No new low-temperature phases were observed by XRD. Careful determinations of the composition and temperature dependences of the following parameters were made: c/a ratio, V (unit-cell volume), and Δl/(lΔT). When the XRD results are combined with the solid-state proton NMR parameters that reflect the density of electron states at the Fermi level, mutual support is obtained for the Jahn-Teller splitting of the Zr d bands to produce the tetragonal distortion of the ideal fcc lattice when the stoichiometry exceeds x = 1.66. The lattice constants from XRD confirm that the maximum in the values of the proton NMR parameters that are observed when 1.80 $\leqq$ x $\leqq$ 1.85 is due primarily to the Fermi level falling at the maximum of the lower split d band and is not merely a lattice-temperature effect.

37972 **Preparation of silicon carbide fibers.** Wei, G.C. (to Dept. of Energy). US Patent Application 6-541,188. 12 Oct 1983. 5p. Contract AC05-84OR21400.

Portions are illegible in microfiche products.

Silicon carbide fibers suitable for use in the fabrication of dense, high-strength, high-toughness SiC composites or as thermal insulating materials in oxidizing environments are fabricated by a new, simplified method wherein a mixture of short-length rayon fibers and colloidal silica is homogenized in a water slurry. Water is removed from the mixture by drying in air at 120°C and the fibers are carbonized by (pyrolysis) heating the mixture to 800 to 1000°C in argon. The mixture is subsequently reacted at 1550 to 1900°C in argon to yield pure β-SiC fibers.

37973 **Fracture toughness of Al_2O_3-ZrO_2 composites.** Becher, P.F.; Tennery, V.J. (Oak Ridge National Lab., TN). pp 383-399 of Fracture mechanics of ceramics. Vol. 6. Bradt, R.C.; Evans, A.G.; Hasselman, D.P.H.; Lange, F.F. (eds.). New York, NY; Plenum Publishing Corporation (1983).

The fracture toughness (K/sub IC/) of Al_2O_3-ZrO_2 two phase ceramic composites was determined for several compositions of different ZrO_2/Al_2O_3 ratios and selected Y_2O_3 concentrations in the ZrO_2. The fracture toughness was determined for the materials using the double cantilver beam (DCB) specimen geometry. Fracture toughness of these ceramics was a function of the chemical precursor employed for the Al_2O_3, hence the microstructure of the hot pressed ceramics, the ZrO_2/Al_2O_3 ratio, and the concentration of Y_2O_3 stabilizer present in the ZrO_2 phase. In composites containing 20 vol % ZrO_2, K/sub IC/ increases (4.6 to 8.5 MPa m/sup 1/2/) with decrease in Y_2O_3 content from 3 to 1 mol %. On the other hand, in composites containing 30 vol % ZrO_2, decreasing Y_2O_3 additions from 3 to 2 mol % leads to a maximum in K/sub IC/ value of about 6.2 MPa m/sup 1/2/ which occurred in a composition containing 2 mol % Y_2O_3. In this same composite, this maximum shifts to a value of about 8 MPa m/sup 1/2/ at about 2 to 3 mol % Y_2O_3 at -195°C. These observations are consistent with a transformation toughening model wherein an increase in toughness occurs with decrease in Y_2O_3 content due to a decrease in the chemical free energy required for the transformation of tetragonal ZrO_2 to the monoclinic form. The K/sub IC/ also exhibits a maximum with the concentration of ZrO_2 particles and this maximum in K/sub IC/ increases in value and shifts to higher ZrO_2 contents with Y_2O_3 stabilizer concentrations of 2 mol %.

37974 **Dual cobalt speciation in Co/ZSM-5 catalysts.** Stencel, J.M.; Rao, V.U.S.; Diehl, J.R.; Rhee, K.H.; Dhere, A.G.; DeAngelis, R.J. (Pittsburgh Energy Tech. Center, PA). *Journal of Catalysis;* **84**: 109-118(1983).

X-Ray diffraction, X-ray photoelectron spectroscopy, and infrared spectroscopy are used to investigate cobalt speciation in Co/ZSM-5 catalysts containing 1.4 to 9.5 wt% cobalt. These catalysts, metal-impregnated using incipient wetness techniques with $Co(NO_3)_2$ x $6H_2O$, are shown to contain highly dispersed, ion-exchanged, non-reducible Co^{2+} species interior to the ZSM-5, and large, reducible cobalt oxide crystallites on the exterior of the ZSM-5 crystallite surface. The number of Co^{2+} ions located inside a unit cell of ZSM-5 and the number of pyridine molecules that coordinately bond to each of these ions are estimated by using infrared data characterizing pyridine chemisorption. The crystalline forms of cobalt on the surface of the ZSM-5 are identified and their sizes estimated after O_2 calcination, H_2 reduction, and CO + H_2 exposure. These data are then scrutinized for correlations of chemical and physical properties of the Co/ZSM-5 catalysts with conversion activity and selectivity for synthesis of hydrocarbons from CO + H_2 gas. 15 references, 5 figures, 3 tables.

3603 Composite Materials

REFER ALSO TO CITATION(S) 36030038116

37975 **(DOE/ER/10556—99) Work hardening of simple two phase composites.** Beck, R.T. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jun 1984. Contract AC02-80ER10556. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014629.

Portions are illegible in microfiche products; thesis.

For composites with a lightly hardening matrix, work hardening occurs whenever primary slip regions are inhibited from developing. Elastic inclusions impose approximately the same restrictions as rigid inclusions on the internal deformation of the matrix. The macroscopic stress-strain curve obtained for these, however, is considerably lower than that for the rigid inclusion case (except at very small concentrations). Interparticle distance effects on the macroscopic hardening are most apparent for cases where the matrix is lightly hardening. The characterization of the matrix material by a simple phenomenological plasticity theory does not seem to predict the hardening response of metal alloys with small volume fractions of hard phase.

37976 (INIS-SU—197, pp 53-58) **Study of the radiation damage and the behaviour of helium in carbon-graphite materials with pyrocarbon bond.** Ashrapov, T.B.; Abdusalyamov, N.; Artemov, S.V. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780108.

In Radiation damage physics and radiation technology.

Radiation strength of carbon-graphite materials under low-temperature 32 MeV α-radiation up to 10^{17} frxcm^{-2} dose imitating radiation of intense neutron fluences in high-temperature gas-cooled reactors and thermonuclear facilities is studied. Form change of irradiated samples is investigated. Change of crystal lattice parameters of the investigated materials after radiation is measured. Slight increase of thickness of irradiated samples and increase of lattice parameter along "C" axis is determined. Methods of thermodesorption spectrometry have been used to determine temperature stages and activation energies of helium yield from irradiated materials. Changes in electric resistance of irradiated samples are investigated. It is stated that annealing of irradiated samples at 1200 deg C results in incomplete reduction of their electric resistance that is, probably, caused by rest radiation defects because helium completely leaves the material at this temperature. The obtained results of the investigation are discussed.

3604 Polymers And Plastics

37977 **Permeability of deuterium and helium on poly(vinyl alcohol).** Carstens, D.H.W.; Ehart, E.P. (Los Alamos National Lab., NM). *Journal of Applied Polymer Science;* **29**: No. 1, 261-268(Jan 1984).

The permeabilities of deuterium and helium-4 through poly (vinyl alcohol) (PVA) over the temperature range of 25-125{ C are reported. For deuterium, permeabilities ranged from 0.5 X 10^{-18} mol-m/m^2-s-Pa at these two extreme temperatures. Helium permeabilities were roughly five times higher. The effects of different curing temperatures and time on the deuterium permeability were studied found that, to within experimental error, results were the same for samples heat treated at any temperature between 100° C and 140° C. Aluminizing the samples using a special process decreased the permeabilities by a factor of at least 5. A sensitive apparatus constructed around a quadrupole spectrometer was used to measure the very low permeabilities. The apparatus is described in detail. 2 figures, 1 table.

3606 Other Mnterials

REFER ALSO TO CITATION(S) 36060037332, 37431, 37436, 37438, 37438, 37634, 37976, 38046, 38081, 38086, 38902, 38904

37978 **(AD-A—138094/8) Electrical, luminescence and SIMS (secondary ion mass spectroscopy) characterization of carbon implanted vapor phase epitaxial gallium arsenide. Doctoral thesis.** Sydenstricker, R.M. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1983. 273p. (AFIT/DS/PH—83-4). NTIS, PC A12/MF A01.

The electrical, luminescence and mass distribution properties of carbon implanted VPE GaAs have been analyzed. Room temperature Hall measurements and low temperature photoluminescence, each combined with chemical etching, and SIMS experiments were performed on VPE GaAs which had been implanted with 120 keV carbon atoms in doses ranging from 1 x 10 to the 13th power/sq. cm. to 1 x 10 to the 15th power/sq. cm. These samples were subsequently encapsulated with chemical vapor deposition Si3N4 and annealed at 850 C to 950 C for 15 minutes in flowing H2. Unimplanted and neon implanted control samples were also analyzed. The electrical and photoluminescence etch data independently identify a saturation effect for substitutional carbon acceptors at a concentration of approximately 3 x 10 to the 17th power/cc. The overall conclusion is that for carbon concentrations above approximately 3 x 10 to the 17th power/cc the excess carbon will not go substitutional and that for carbon concentrations less than 3 x 10 to the 17th power/cc, the carbon will reside predominately on As sites as an acceptor. Thus, despite the fact that carbon is a Group IVA impurity in GaAs, it is not likely to demonstrate amphoteric behavior as have other Group IVA dopants.

37979 (INIS-SU—236, pp 162-166) **Radiation-induced and growth defects in oxide crystals.** Gritsyna, V.T. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The structure and charge states of point defects were investigated in simple and mixed oxides α-Al_2O_3 and $MgAl_2O_4$. Using methods of optical and thermally activated spectroscopy, X-ray and photoluminescence of crystals irradiated with UV-light, X-rays, electrons and neutrons were studied and characteristics of growth and radiation induced defects were identified.

37980 (INIS-SU—236, pp 167-171) **Defect-production efficiency in spinel crystals under electron and gamma-neutron irradiation.** Gritsyna, V.T.; Kobyakov, V.A.; Litvinov, L.A. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The origin and concentration of defects in $MgOxnAl_2O_3$ (n=1 and 2.5) crystals were investigated after irradiation with reactor neutrons, electrons, X-rays and UV-light. Low efficiency of defect production in cation sublattice are explained by small coefficient of cation site filling.

37981 (INIS-SU—236, pp 219-223) **Germanium neutron doping its application and properties.** Zabrodskij, A.G. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The problem of neutron transmutation doping of germanium is considered with special emphasis on nuclear physics aspects.

37982 (N—8330271) Advanced methods for preparation and characterization of infrared detector materials. Final Report, 30 Sep 1981-15 Feb 1983. Broerman, J.G.; Morris, B.J.; Meschter, P.J. (McDonnell Douglas Research Labs., St. Louis, MO (USA)). Feb 1983. 28p. (NASA-CR—170798). NTIS, PC A03/MF A01.

Crystals were prepared by the Bridgman-Stockbarger method with a wide range of crystal growth rates and temperature gradients adequate to prevent constitutional supercooling under diffusion-limited, steady-state, growth conditions. The longitudinal compositional gradients for different growth conditions and alloy compositions were calculated and compared with experimental data to develop a quantitative model of solute redistribution during the crystal growth of the alloys. Measurements were performed to ascertain the effect of growth conditions on radial compositional gradients. The pseudobinary HgTe-CdTe constitutional phase diagram was determined by precision differential-thermal-analysis measurements and used to calculate the segregation coefficient of Cd as a function of x and interface temperature. Experiments were conducted to determine the ternary phase equilibria in selected regions of the Hg-Cd-Te constitional phase diagram. Electron and hole mobilities as functions of temperature were analyzed to establish charge-carrier scattering probabilities. Computer algorithms specific to Hg(1-x)CdxTe were developed for calculations of the charge-carrier concentration, charge-carrier mobilities, Hall coefficient, and Dermi Fermi energy as functions of x, temperature, ionized donor and acceptor concentrations, and neutral defect concentrations.

37983 Point defects in neutron-irradiated quartz. Jani, M.G.; Halliburton, L.E. (Physics Department, Oklahoma State University, Stillwater, Oklahoma 74078). *Journal of Applied Physics;* **56**: No. 4, 942-946(15 Aug 1984).

Point defects formed by irradiation with fast neutrons have been characterized in high-quality synthetic quartz using electron spin resonance and optical absorption techniques. Among the paramagnetic defects generated are the E/sup prime/$_1$ center, the $[AlO_4]^0$ center, and two previously unreported S = 1 centers. Production and thermal annealing characteristics of these more prominent defects are described. The two S = 1 defects have g/sub c/ values of 2.0205 and 2.0158 and thermally decay near 250 and 470 °C, respectively. They each consist of a pair of unpaired spins (i.e., holes) separated by approximately 5 A, and either vacancies or interstitials are a part of their models. These latter two centers, along with the E/sup /$_1$ centers, result from direct displacements during the neutron irradiation. An optical absorption band at 210 nm grows at the same rate during irradiation as the E/sup prime/$_1$ centers and S = 1 centers but cannot be definitely assigned to particular defects.

37984 Dependence of radiation-induced interface traps on gate Al thickness in metal/SiO_2/Si structures. Zekeriya, V.; Ma, T. (Department of Electrical Engineering, Yale University, New Haven, Connecticut 06520). *Journal of Applied Physics;* **56**: No. 4, 1017-1020(15 Aug 1984).

Generation of interface traps by ionizing radiation at the Si interface of an Al/SiO_2/Si structure has been studied for Al thicknesses in the 500—13000 A range for devices both with and without post-metal-anneal (PMA) treatment. In parallel with that, the interfacial stresses have been determined for the same structures by means of a laser beam reflection technique. The generation of radiation-induced interface traps, as well as the interfacial stresses, depend strongly on Al thickness and PMA treatment. Results suggest that radiation sensitivity and interfacial stresses are closely related. Two mechanisms, both of which depend on the interfacial strained bonds, can explain the results. According to the first one, reformation of bonds broken by radiation depends on the Si surface strain, which in turn is a function of Al thickness and PMA. The second one is based on the bond strain gradient model proposed by F. J. Grunthaner, P. J. Grunthaner, and J. Maserjian [IEEE Trans. Nucl. Sci. NS-29, 1462 (1982)] in which interface trap generation is a consequence of the propagation of the radiation-induced bonding defects under the bond strain gradient. This process depends on the magnitude of such a gradient, in consistency with the observed dependencies of the radiation sensitivity.

37985 Origin of interfacial charging in irradiated silicon nitride capacitors. Hughes, R.C. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **56**: No. 4, 1044-1050(15 Aug 1984). Contract AC04-76DP00789.

Many experiments show that when metal-silicon nitride-silicon dioxide-silicon (MNOS) devices are irradiated in short circuit, a large interfacial charge builds up near the nitride-SiO_2-Si interface. This effect cannot be explained by simple models of radiation-induced conductivity of the nitride, but it is reported here that inclusion of carrier diffusion and recombination in the photoconductivity equations can predict the observed behavior. Numerical solutions on a computer are required, however, when these complications are added. The simulations account for the magnitude and radiation dose dependence of the results, as well as the occurrence of a steady state during the irradiation. The location of the excess trapped charge near the interface is also predicted, along with the large number of new traps which must be introduced to influence the steady-state charge distribution.

37986 Electrical properties of semiconducting glasses in the quasi-binary $CdGeAs_2$-$CdSiAs_2$ system. Bhattacherjee, A.P.; Risbud, S.H. (Department of Ceramic Engineering and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Journal of Applied Physics;* **56**: No. 4, 1080-1085(15 Aug 1984). Contract AC02-76ER01198.

The electrical properties of melt quenched CdGe/sub 1-x/Si/sub x/As_2 glasses and crystallized glasses were investigated. The activation energy for electrical conductivity of glasses followed Vergard's law in the composition range x = 0.5—1.0. Compositions with x<0.5 were inhomogeneous due to amorphous phase separation resulting in significant departures from Vegard's law. Crystallization of glasses by vacuum heat treatment resulted in reversal in the type of conductivity. Hall measurements suggest greater degeneracy and high conductivity of the x = 0.5 glass; this composition also showed the least temperature dependence of the electrical properties. The experimental data on phase stability, electrical and transport properties of the quasi-binary $CdGeAs_2$-$CdSiAs_2$ glasses are discussed in the context of potential device applications.

37987 Figures of merit for sputtered superlattices. Falco, C.M. (Departments of Physics and of Optical Sciences and in the Arizona Research Laboratories, University of Arizona, Tucson, Arizona 85721). *Journal of Applied Physics;* **56**: No. 4, 1218-1219(15 Aug 1984). Contract AC02-83ER45025.

Two figures of merit for sputtered superlattices (FMSS) are proposed which allow a comparison of the quality of artificial superlattices prepared in different sputtering systems. These FMSS also demonstrate several conditions for optimizing the sputtering parameters which are not widely appreciated.

37988 Depth profiles of perpendicular and parallel strain in a GaAs/sub x/P_1/sub -x//GaP superlattice. Speriosu, V.S.; Nicolet, M.; Picraux, S.T.; Biefeld, R.M. (California Instiute of Technology, Pasadena, California 91125). *Applied Physics Letters;* **45**: No. 3, 223-225(1 Aug 1984). Contract AC04-76DP00789.

Using double-crystal x-ray rocking curves, depth profiles of parallel and perpendicular strain were obtained in a GaAs/sub 0.14/P/sub 0.86//GaP superlattice grown on a buffer layer on (100) GaP. Combining symmetric Fe K/sub alpha1/ (400) and asymmetric Cu K/sub alpha1/ (422) reflections, a constant parallel strain of 0.19% relative to the substrate was found throughout the superlattice and buffer layer. Relative to the substrate, the perpendicular strain was found to be 0.26% in the buffer, and 0.80% and -0.19% in the 176-A-thick superlattice GaAs/sub x/P/sub 1-x/ and GaP layers, respectively. The strain profiles indicate the buffer is ~80% decoupled from the substrate by misfit dislocations near the buffer/substrate interface, and the lattice misfit in the superlattice is elastically accommodated by the epitaxial structure with a small shift in the average lattice constant relative to the equilibrium superlattice structure.

37989 Dispersion of the refractive index of ternary compound Pb/sub 1-x/Sn/sub x/Te. Jensen, B.; Torabi, A. (Department of Physics, Boston University, Boston, Massachusetts 02215). *Applied Physics Letters;* **45**: No. 3, 266-268(1 Aug 1984). Contract AC02-79ER10444.

The refractive index of Pb/sub 1-x/Sn/sub x/Te below the fundamental absorption edge is calculated as a function of photon energy and carrier concentration. Use of the band structure of the Kane theory results in a good agreement of theory with experiment. Numerical values of the refractive index for some values of x in the range 0< or =x< or =0.42 are given and discussed.

37990 Optical approach to thermopower and conductivity measurements in thin-film semiconductors. Dersch, H.; Amer, N.M. (Applied Physics & Laser Spectroscopy Group, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Applied Physics Letters;* **45**: No. 3, 272-274(1 Aug 1984). Contract AC03-76SF00098.

An optical beam deflection technique is applied to measure the Joule and Peltier heat generated by electric currents through thin-film semiconductors. The method yields a spatially resolved conductivity profile and allows the determination of Peltier coefficients. Results obtained on doped hydrogenated amorphous silicon films are presented.

37991 Growth and patterning of GaAs/Ge single crystal layers on Si substrates by molecular beam epitaxy. Sheldon, P.; Jones, K.M.; Hayes, R.E.; Tsaur, B.; Fan, J.C.C. (Solar Energy Research Institute, Photovoltaic Devices and Measurements Branch, Golden, Colorado 80401). *Applied Physics Letters;* **45**: No. 3, 274-276(1 Aug 1984). Contract AC02-77CH00178.

Single crystal GaAs layers have been grown on Si substrates with an intermediate Ge layer. Both the Ge and subsequent GaAs are grown in situ by molecular beam epitaxy (MBE). Cross-sectional transmission electron microscopy studies show GaAs surface dislocation densities on the order of 10^7 cm^{-2}. The quality of the GaAs is indicated by a mobility within 15% of that measured on GaAs/GaAs MBE structures doped at the same level. This material also exhibits a photoluminescence signal with a room-temperature intensity about 50% of GaAs grown on GaAs, and with a similar half-width. In this letter, electron diffraction, optical and electrical data are presented for n-type GaAs/Ge/Si structures. In addition, a selective lift-off technique is demonstrated, with possible applications in the development of monolithic GaAs/Si integrated circuits.

37992 Transmission electron microscope studies of crystalline $LiNbO_3$. Pareja, R.; Gonzalez, R.; Chen, Y. (Departamento de Fisica del Estado Solido, Facultad de Ciencias Fisicas, Universidad Complutense, Madrid, Spain). *Journal of Applied Physics;* **56**: No. 3, 660-663(1 Aug 1984). Contract W-7405-ENG-26.

Transmission electron microscope investigations in both as-grown and hydrogen-reduced $LiNbO_3$ reveal that niobium oxide precipitates can be produced by in situ irradiations in the electron microscope. The precipitation process is produced by a combined effect of ionizing electrons and the thermal heating of the specimens during irradiation. It is proposed that the composition of the precipitates is primarily Nb_2O_5.

37993 Directly heated lanthanum hexaboride filaments. Leung, K.N.; Pincosy, P.A.; Ehlers, K.W. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Review of Scientific Instruments;* **55**: No. 7, 1064-1068(Jul 1984). Contract AC03-76SF00098.

Some physical properties of lanthanum hexaboride filaments, when operated as cathodes in a gas discharge, are presented. These directly heated hairpin-shaped filaments have been tested in different types of ion sources and are shown to be capable of long-pulse or cw discharge operations. The design of a shaped lanthanum hexaboride filament for the purpose of further extension of lifetime is also described.

37994 Melting temperature and explosive crystallization of amorphous silicon during pulsed laser irradiation. Thompson, M.O.; Galvin, G.J.; Mayer, J.W.; Peercy, P.S.; Poate, J.M.; Jacobson, D.C.; Cullis, A.G.; Chew, N.G. (Department of Material Science, Cornell University, Ithaca, New York 14853). *Physical Review Letters;* **52**: No. 26, 2360-2363(25 Jun 1984). Contract AC04-76DP00789.

Measurements during pulsed laser irradiation indicate that amorphous Si melts at a temperature 200 +- 50 K below the crystalline value. Below energy densities required to melt the amorphous layer fully , the data are interpreted in terms of an explosive crystallization. The initial liquid layer solidifies to form coarse grained polycrystalline Si. A thin, self-propagating liquid layer travels through the remaining amorphous Si at a velocity of 10—20 m/s, producing fine grained polycrystalline Si.

37995 Fractal geometry of colloidal aggregates. Schaefer, D.W.; Martin, J.E.; Wiltzius, P.; Cannell, D.S. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **52**: No. 26, 2371-2374(25 Jun 1984). Contract AC04-76DP00789.

Measurement of the fractal dimension, D, of colloidal aggregates of small silica particles is reported. We observe power-law decay of the structure factor [S(k)~k/sup -D/] by both light and x-ray scattering showing that the aggregates are fractal. D is found to be 2.12 +- 0.05, which is intermediate between recent numerical results for the kinetic models of diffusion-limited aggregation (D = 2.5) and cluster aggregation (D = 1.75), but is rather close to the value for lattice animals (D = 2.0), which are equilibrium structures.

37996 Observation of exceptional temperature humidity stability in multilayer filter coatings. Coult, D.; Jones, J.; Martin, P.; Pawlewicz, W. (AT & T Bell Laboratories, Allentown, Pennsylvania 18103). *Applied Optics;* **23**: No. 9, 1307-1308(1 May 1984). Contract AC06-76RL01830.

Reactively sputtered optical coatings are reported that are remarkably stable under temperature and humidity variations.(AIP)

37997 Temperature dependence of the structure factor of GeS_2 glass. Lin, C.; Busse, L.E.; Nagel, S.R.; Faber, J. (The James Franck Institute and Department of Physics, The University of Chicago, Chicago, Illinois 60637). *Physical Review [Section] B: Condensed Matter;* **29**: No. 9, 5060-5062(1 May 1984).

We have measured the temperature dependence of the first two peaks in the structure factor of GeS_2 glass. The first peak shows an increase in intensity between 300 and 523 K. The second-peak intensity is practically independent of T in this range. This anomalous behavior is similar to that found in As_2Se_3 and As/sub x/S/sub 1-x/ glasses which also appear to have a short-range order corresponding to layers.

37998 Phase transitions in diluted magnets: Critical behavior, percolation, and random fields. Birgeneau, R.J.; Cowley, R.A.; Shirane, G.; Yoshizawa, H. (Department of Physics, University of Edinburgh, Edinburgh EH9 3JZ, Scotland). *Journal of Statistical Physics;* **34**: No. 3, 817-940(Mar 1984). Contract AC02-76CH00016.

Transition metal halides provide realizations of Ising, XY, and Heisenberg antiferromagnetis in one, two, and three dimensions. The interactions which are of short range, are generally well understood. By dilution with nonmagnetic species such as Zn^{++} or Mg^{++} one is able to prepare site-random alloys which correspond to random systems of particular interest in statistical mechanics. By mixing two magnetic ions such as Fe^{++} and Co^{++} one can produce magnetic crystals with competing interactions- either in the form of competing anisotropies or competing ferromagnetic and antiferromagnetic interactions. In this paper the results of a series of neutron scattering experiments on these systems carried out at Brookhaven over the past several years are briefly reviewed. First the critical behavior in Rb_2Mn/sub 0.5/Ni/sub 0.5/F_4 and Fe/sub c/Zn/sub 1-c/F_2 which correspond to two-dimensional and three-dimensional random Ising systems, respectively, are discussed. Percolation phenomena have been studied in Rb_2Mn/sub c/Mg/sub 1-c/F_4,

Rb_2Co/sub c/Mg/sub 1-c/F_4, KMn/sub c/Z/sub 1-c/F_3, and Mn/sub c/Zn/sub 1-c/F_2 which correspond to two- and three-dimensional Heisenberg and Ising models, respectively. In these cases c is chosen to be in the neighborhood of the nearest-neighbor percolation concentration. Application of a uniform field to the above systems generates a random staggered magnetic field; this has facilitated a systematic study of the random field problem. As we shall discuss in detail, a variety of novel, unexpected phenomena have been observed.

37999 **Epitaxial crystal growth by sputter deposition: Applications to semiconductors. Part 2.** Greene, J.E. (Department of Mettallurgy, Coordinated Science Laboratory, and Materials Research Laboratory, University of Illinois, Urbana, Illinois). *CRC Critical Reviews in Solid State and Materials Sciences;* **11**: No. 3, 189-228(Jan 1984). Contract AC02-76ER01198.

The understanding of the physics of ion-surface interactions has progressed sufficiently to allow sputter depositinn to be used as a crystal growth technique for depositing a wide variety of single crystal elemental, compound, alloy, and superlattice semiconductors. In many cases, films with essentially bulk values of carrier concentrations and mobilities have been obtained. The controlled use of low energy particle bombardment of the growing film during sputter deposition has been shown to affect all stages of crystal growth ranging from adatom mobilities and nucleation kinetics to elemental incorporation probabilities. Such effects provide inherent advantages for sputter deposition over other vapor phase techniques for the low temperature growth of compound and alloy semiconductors and are essential in allowing the growth of new and unique single crystal metastable semiconductors. Part 1 of this review includes sections on experimental techniques, the physics of ion-surface interactions, and ion bombardment effects on film nucleation and growth, while Part 2 presents a discussion of recent results in the growth of elemental, III-V, II-VI, IV-VI, metastable, and other compound semiconductors.

38000 **Interaction of magnetic domain walls with microstructural features in spinel ferrites.** Lin, I.A.; Mishra, R.K.; Thomas, G. (Dept. of Materials Science and Mineral Engineering Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **20**: No. 1, 134-139(Jan 1984).

Lorentz microscopy studies of (Mn, Zn)Fe_2O_4 and $LiFe_5O_8$ show that grain boundaries, pores, microcracks, stacking faults, and nonmagnetic second phase particles act as pinning sites for moving domain walls. Second phase particles, pores, and some grain boundaries also act as favorable sites for reverse domains to be nucleated. In addition, it is observed that domain walls cannot move smoothly as they approach a grain boundary.

38001 **Formation of partially coherent antimony precipitates in ion implanted thermally annealed silicon.** Pennycook, S.J.; Narayan, J.; Holland, O.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Applied Physics;* **54**: No. 12, 6875-6878(Dec 1983). Contract W-7405-ENG-26.

Thermal annealing of a supersaturated solid solution of antimony in silicon results in the formation of partially coherent antimony precipitates. Transmission electron microscopy and microdiffraction studies show the precipitates to be bounded by {112} Si surfaces with the {111} Si and {1012} Sb planes coherent across the interface. The role of dislocations in the growth of the precipitates is discussed.

38002 **Some basic questions in organic superconductivity.** Emery, V.J. (Brookhaven National Lab., Upton, NY). *Journal de Physique (Paris), Colloque;* **44**: No. 6, 977-982(Jun 1983). Contract AC02-76CH00016.

Several questions of current interest in the theory of organic superconductors are discussed. Particular attention is paid to the importance of low-dimensional physics, electron-electron interactions, and the specific role of the anions.

38003 **Heat-treatment effects in neutron transmutation doped epitaxial silicon.** Cleland, J.W. (Oak Ridge National Lab., TN). *Journal of the Electrochemical Society;* **130**: No. 1, 227-228(Jan 1983). Contract W-7405-ENG-26.

Chemical vapor deposition (CVD) of silicon from a gaseous silicon compound onto a heated silicon substrate may be used to deposit an epitaxial SI layer and to obtain an electrical p-n junction. The dopant concentration in the epi-Si layer is a function of the gaseous dopant ion content, flow rate, temperature gradient, and any migration of impurities (autodoping) from the heated substrate. This technical note describes some results of carrier concentration, mobility, and resistivity measurements on small (0.5 cm^2) epi-Si samples using the van der Pauw (vdP) technique.

38004 **Surface studies of laser annealed semiconductors.** Zehner, D.M.; White, C.W. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **13**: 317-328(1983). Contract W-7405-ENG-26.

The surface regions of semiconductor single crystals have been examined following laser annealing in an ultrahigh vacuum environment with the output of a pulsed ruby laser. Atomically clean surfaces with impurity levels below 0.1% of a monolayer can be produced by multiple pulse irradiation. Ordered surface structures are produced on low index oriented crystals as well as crystals slightly misoriented. Metastable surface structures exhibiting (1x1) LEED patterns have been produced on (111) orientations and are believed to be a consequence of the rapid coolig rates of 10^9 degs/sec achieved with the laser irradiation process. The surface and subsurface regions of ion-implanted Si crystals have been examined both before and after laser irradiation and results obtained from Si samples implanted with As are discussed.

38005 **Crystallization of silicon films on glass: a comparison of methods.** Lemons, R.A.; Bosch, M.A.; Herbst, D. (Los Alamos National Lab., NM). *Materials Research Society Symposia Proceedings;* **13**: 581-592(1983).

The lure of flat panel displays has stimulated much research on the crystallization of silicon films deposited on large-area transparent substrates. In most respects, fused quartz is ideal. It has high purity, thermal shock resistance, and a softening point above the silicon melting temperature. Unfortunately, fused quartz has such a small thermal expansion that the silicon film cracks as it cools. This problem has been attacked by patterning with islands or moats before and after crystallization, by capping, and by using silicate glass substrates that match the thermal expansion of silicon. The relative merits of these methods are compared. Melting of the silicon film to achieve high mobility has been accomplished by a variety of methods including lasers, electron beams, and strip heaters. For low melting temperature glasses, surface heating with a laser or electron beam is essential. Larger grains are obtained with the high bias temperature, strip heater techniques. The low-angle grain boundaries characteristic of these films may be caused by constitutional undercooling. A model is developed to predict the boundary spacing as a function of scan rate and temperature gradient.

38006 **Flame annealing of ion implanted silicon.** Narayan, J.; Young, R.T. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **13**: 361-367(1983). Contract W-7405-ENG-26.

The authors investigated flame annealing of ion implantation damage (consisting of amorphous layers and dislocation loops) in (100) and (111) silicon substrates. The temperature of a hydrogen flame was varied from 1050 to 1200°C and the interaction time from 5 to 10 seconds. Detailed TEM results showed that a defect-free annealing of amorphous layers by solid-phase-epitaxial growth could be achieved up to a certain concentration. However, dislocation loops in the region below the amorphous layer exhibited coarsening, i.e., the average loop size increased while the number density of loops decreased. Above a critical loop density, which was found to be a function of ion implantation variables and substrate temperature, formation of 90° dislocations (a cross-grid of dislocation in (100) and a triangular grid in (111) specimens) were observed. Electrical (Van der Pauw) measurements indicated nearly a complete electrical activation of dopants with mobility comparable to pulsed laser annealed specimens. The characteristics of p-n junction diodes

showed a good diode perfection factor of 1.20-1.25 and low reverse bias currents.

38007 **Pulsed excimer laser (308 nm) annealing of ion implanted silicon and solar cell fabrication.** Lowndes, D.H.; Cleland, J.W.; Christie, W.H.; Eby, R.E.; Jellison, G.E. Jr.; Narayon, J.; Westbrook, R.D.; Wood, R.F.; Nilson, J.A.; Dass, S.C. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **13**: 407-412(1983). Contract W-7405-ENG-26.

A pulsed ultraviolet excimer laser (XeCl, 308 nm wavelength, 40 nsec FWHM pulse duration) has been successfully used for laser annealing of both boron- and arsenic-implanted silicon. TEM, SIMS, and sheet electrical measurements are used to characterize specimens. C-V and I-V measurements demonstrate that near-ideal p-n junctions are formed (diode perfection factor A = 1.2). Electrical activation of implanted ions by single laser pulses is essentially complete for energy densities E/sub l/ greater than or equal to 1.4 J/cm², far below the threshold for substantial surface damage —4.5 J/cm². Melting model calculations are in good agreement with observed thresholds for dopant redistribution and for epitaxial regrowth. Changes in annealing behavior resulting from multiple (1,2,5) laser pulses are also reported. Finally, the authors demonstrate the use of scanned overlapping excimer laser pulses for fabrication of large area (2 cm²) solar cells with good performance characteristics. In contrast to pulsed ruby laser annealing, high open circuit voltages can be obtained without the use of substrate heating.

38008 **Explosive recrystallization of ion implantation amorphous silicon layers.** Narayan, J.; Rozgonyi, G.R.; Bensahel, D.; Auvert, G.; Nguyen, V.T.; Rai, A.K. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **13**: 177-184(1983). Contract W-7405-ENG-26.

Explosive recrystallization of amorphous layers, induced by scanned electron or CW Ar^+ laser beams, has been investigated in arsenic implanted (100) specimens. The authors have studied the microstructural changes using plan-view and cross-section electron microscopy to obtain the mechanism of explosive recrystallization phenomonon. The confinement of heat in the amorphous layers during laser irradiation and the nature of amorphous silicon determine the modes of explosive recrystallization. The authors indicate that, depending upon the degree of undercooling, two distinct modes of liquid-phase recrystallization are observed: one occurring at a velocity of $-2\ ms^{-1}$ and the other at $-10\ ms^{-1}$. Explosively recrystallized grains contain <110> and <110> as surface normal and growth direction respectively. The authors present a model for unseeded crystallization to explain the <110> texture observed in diamond cubic lattices.

38009 **Magnetic susceptibility of the extended Hubbard model in one-dimension complexes.** Chui, S.T. (Univ. of Delaware, Newark). *Solid State Communications;* **46**: No. 8, 657-659(1983). Contract AC02-82ER12060.

The magnetic susceptibility of a 1.D electron gas with on site and nearest neighbor Coulomb repulsions (U, V) is discussed in terms of an antiferromagnetic chain with effective exchange J. For band fillings rho $\leqq$ 1/4 J — $4t^4/UV^2$, for band fillings rho $\geqq$ 1/4J — $2t^2/U$. This is substantiated by numerical calculations for finite chains with parameters estimated by Hubbard for TCNQ. The authors find that the effective J increases by a factor of ten at rho — 1/4 for the TCNQ complexes.

38010 **Radiation damage in optical fibers.** Lyons, P.B.; Looney, L.D.; Ogle, J.W. (Los Alamos National Lab., NM). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **380**: 116-121(1983).

From Los Alamos conference on optics '83; Los Alamos, NM, USA (11 Apr 1983).

Optical fibers provide important advantages over coaxial cables for many data transmission applications. Some of these applications require that the fibers transmit data during a radiation pulse. Other applications utilize the fiber as a radiation-to-light transducer. In either case, radiation-induced luminescence and absorption must be understood. Most studies of radiation effects in fibers have emphasized time scales of interest in telecommunication systems, from the msec to hour range. Few studies have concentrated on response at times below $1\ ^+s$. At Los Alamos, both laboratory electron accelerators and nuclear tests have been used as radiation sources to probe this early time region. The use of a fiber (or any optical medium) as a Cerenkov radiation-to-light transducer is discussed. Since the radiation induces attenuation in the medium, the light output is not proportional to the radiation input. The nonlinearity introduced by this attenuation is calculated.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 40010037218, 37218, 37229, 37230, 37231, 37232, 37233, 37234, 37236, 37237, 37239, 37240, 37245, 37346, 37359, 37956, 38497

38011 **(CONF-840415—26) Separation of metal species by supported liquid membranes.** Danesi, P.R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014536.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

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The works performed on the transport and separation properties of supported liquid membranes (SLM) are reviewed. The models and equations which describe the permeation through SLMs of metal species are described. These models have been tested with various carriers absorbed on flat-sheet and hollow-fiber SLMs by measuring the permeation of several metal species of hydrometallurgical and nuclear interest. An equation for the separation factor of metal species in SLM processes and examples of separations of metal ions are reported. The possibility of bypassing the single stage character of SLM separations by using multilayer composite SLMs, arranged in series, is also analyzed. Finally, the factors which control the stability of SLMs are briefly discussed.

38012 **(EUR—8349) Certification of a uranium metal reference material for chemical analyses.** Le Duigou, Y. (Commission of the European Communities, Luxembourg; Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). 1983. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701511.

The procedure followed for the certification of the European Communities uranium metal reference material No. 101 is described in this report. The certificate appended to the report gives the uranium mass fraction, the overall uncertainty attached to that value and recommendations for use of the material.

38013 **(INIS-mf—7782, pp 215-219) Application of certificated according to activity slutions of Pu-238 for determination of concentration of Pu.** Gejdel'man, A.M.; Egorov, Yu.S.; Preobrazhenskaya, L.D.; Khol'nov, Yu.V. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

A precision radiometric method has been developed for determination of Pu concentration in solutions of complicated composition by means of isotope dilution. The essence of this method is in determination of specific activity of Pu in solution and in calc ulation of Pu concentration using the data on isotopic composition and half-life times of Pu isotopes. As an isotopic delutor plutonium-238 has been used. Specific activity of Pu-238 in the solution of "label" was measured by means of the $4\pi\alpha$-x-coincidence method having error not more than 0.1% and confidence level of 0.95. Relation of Pu-238 activity and activity of other iso topes of Pu was determined with error better than 0.1% by means of the low-background semiconductor α-spectrometer. Sepsration of Pu from U, Am and other interfering impurities was done by means of an ion exchange chromatographyc column. Analysis of errors has shown,

that total error in determination of Pu concentration mainly is due to the errors in values of half-life times of Pu isotopes having been used and it equals to 0.20-0.25% with confidence level of 0.95 and variation ratio near to 0.1%. This method has been used for determination of Pu concentrations in samples containing Pu, Pu+Am and Pu+U+Am. This determination h as been done in course of the international experiment on Pu analysis PAFEX-1 which had been conducted by the IAEA Department of Safeguards.

38014 (INIS-mf—8961, pp 276-283) **Preparation and calibration of standard uranium isotope material CCLU 500.** Sus, F.; Klosova, Eh.; Zakourzhil, K.; Kuvik, V.; Fran'kova, V.; Shtepankova, E. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Order of preparation and certification is described in the paper of the standard substance CCLU 5O0 which in one of the most important media for checking operation of mass-spectrometers and for determination of the mass discrimination factor. Special attention was paid to the determination of the ratio of number of atoms of $^{235}U/^{238}U$. From statistical estimation of experimental data comes that trustworthiness of this ratio is on the level of 95% of probability and varies in the limits of 0.9996+-0.0009. Investiment of ^{234}U and ^{236}U isotopes has been determined by the mass-spectrometric method of isotope dilution. Five laboratories of the CMEA member-states have taken part in the certification of this substance.

38015 (INIS-SU—198, pp 587) **Account of summation effects of cascade gamma-quanta in determining the activity of large bulk samples.** Vojtov, A.I.; Matsepulina, E.I.; Polyanskij, A.L.; Poyarkov, V.A.; Strizhak, V.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38016 **(IS—4844) Environmental research and development measurement and dosimetry. Quarterly report, April 1, 1983-June 30, 1983.** (Ames Lab., IA (USA)). Oct 1983. Contract W-7405-ENG-82. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014876.

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Progress is reported on development of methods for determining PAHs, including laser spectroscopy, fluorescence-line-narrowing spectroscopy, rotationally cooled fluorescence spectroscopy, etc. (DLC)

38017 **(JINR—12-82-831) Flotation concentration of trace elements with iron hydroxides in the Cheleken thermal brines by electrolysis.** Maslov, O.D.; Chosnovska, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701507.

The effect of pH on the behaviour of a range of ions (Fe, Zn, As, Y, No, Ir, Pt, Au, Hg, Pb) and their radioisotopes in the electroflotation process of the geothermal brines is investigated. The possibility of the application of the flotation process without addition on surface active agents to concentrate trace elements with iron hydroxides by the electrolysis of geothermal brines is shown.

38018 **(JINR—12-82-852) Concentration and isolation of the rare earth trace amounts using insoluble collectors.** Do Kim Tyung; Lebedev, N.A.; Nguen Guin' Maj; Nguen Kong Chang; Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701515.

Chemical behaviour of microamounts of lanthanides in solutions of fluorides of tantalum and other elements in the presence of insoluble materials as collectors (ion exchangers, cellulose, activated carbon, graphite) of high dispersity has been investigated. Separation of precipitates has been carried out by filtration on a porous teflon. In the presence of 0.4-0.8 mg/ml of collectors, about 90% lanthanides could be isolated at their concentration of 100-200 times lower as compared with direct coprecipitation with fluorides. Express method for preparation of radioactive lanthanides from irradiated with high energy protons tantalum has been developed. This technique could also be used for concentration of rare earth elements in analysing materials.

38019 **(JINR—18-82-340) Elementary analysis of massive samples at excitation of characteristic x-radiation by proton beams.** Altynov, V.A.; Blokhin, S.M.; Brazevich, Eh.; Brazevich, Ya.; Lyu Zaj Ik; Osetinskij, G.M.; Purehv, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701508.

A simplified method is described for calculating the elementary composition in the massive samples in the case of the detection of the characteristic X-radiation emitted under the bombardment of the samples by a beam of protons. The method was experimentally verified by measuring the characteristic X-radiation from the elements with a known concentration entering the one-component and multi-component matrix. It was shown that within the experimental accuracy the discussed method gave results analogous to those obtained with the earlier used methods.

38020 **(KIYI—82-17) Instrumental gamma-activation analysis of products of the current chemical source production using the microtrons.** Semenov, V.A.; Kozintsev, V.S.; Kishel'gof, V.V. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701509.

An instrumental gamma-activation analysis of products of the current chemical source production was carried out on microtrons (Esub(γsub(max))=13.6 MeV) of the Saratov State University and Kiev Institute for Nuclear Research. An anode and cathode masses in the form of finely divided powder were investigated. Ni, Ba, Co were determined in cathode mass and Cd, Ni were determined in anode mass. Time of analysis was not higher than 45 min. An optimum conditions are calculated for the active mass gamma-activation analysis.

38021 **(PER—69) Report on the feasibility of the in situ radiometric determination of uranium grade in Witwatersrand gold and uranium mines.** Smit, C.J.B.; Wesolinski, E.S.; Corner, B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Aug 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701510.

The chip-sampling technique currently employed by the South African gold and uranium-mining industry, for the prediction of face grade, has several drawbacks, namely: 1) it is labour-intensive; 2) sample volumes are often unrepresentative and prone to human error; and 3) the uranium mineralisation may be very erratic along the reef. In situ radiometric assaying for uranium along the reef, on the other hand, is a rapid, essentially one-man operation, enabling a much larger and hence a more representative sample volume to be measured. The high radiometric background inherent in any uranium mine necessitates some form of high-density shielding in order to facilitate quantitative in situ assaying. This report, therefore, briefly outlines the origin, nature, detection and shielding of gamma rays. Results obtained with a frontally shielded total-count instrument showed that radiometric estimates of uranium grade are comparable to those obtained by batch mining and can be used for the prediction of face grades, provided that the ore is in radiometric equilibrium and that thorium and potassium are either not present, or vary sympathetically with the uranium grade. Spectral analysis showed, however, that these circumstances will also permit the use of a collimated (side-shielded) detector of acceptable weight, provided that only the low-energy portion of the spectrum is measured. The advantages of a collimated detector over a frontally shielded detector are also noteworthy, viz.: 1) only one reading is taken per sample point rather than two, as is the case with the frontally shielded system, thus improving counting statistics; and 2) the shielding is permanently fixed to the detector. Compre-

hensive design considerations for a compact, portable instrument are suggested and methods for determining background radiation as applicable to a collimated detector are described.

38022 **(PER—80) Determination of trace elements in uranium ores by x-ray fluorescence spectrometry.** De Villiers, W. van Z. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria; Rand Afrikaans Univ., Johannesburg (South Africa)). Nov 1983. 76p. (In Afrikaans). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84702562.

The determination of 17 trace elements (As, Ba, Co, Cr, Cu, Mo, Nb, Ni, Pb, Rb, Sr, Th, U, V, Y, Zn and Zr) in uranium ores by x-ray fluorescence spectrometry was investigated in this study. The determination of major elements was also necessary for the calculation of mass absorption coefficients. Initially a method was developed for the determination of the elements of interest in unmineralised silicates. Correction for absorption of radiation by the sample were made by means of mass absorption coefficients which were obtained from the relation between the inverse of the mass absorption coefficient and the intensity of the Compton scattering peak. The Feather and Willis method was used for determining the background intensity at the peak positions as well as for mass absorption coefficients. It was observed that the background intensity in the region of the uranium lines increases with increasing uranium content of the sample.

38023 **NMR study of the structure of simple molecules adsorbed on metal surfaces: C_2H_2 on Pt.** Wang, P.; Slichter, C.P.; Sinfelt, J.H. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review Letters;* **53**: No. 1, 82-85(2 Jul 1984). Contract AC02-76ER01198.

The authors have used NMR to determine the structure of C_2H_2 adsorbed at room temperature on small platinum particles by probing the ^{13}C-^{13}C, ^{13}C-^{1}H, and ^{1}H-^{1}H dipolar interactions among the nuclei in the adsorbed molecules. They find a model of (77 +- 7)% CCH_2 and (23 +- 7)% HCCH. The C-C bond length of the CCH_2 is 1.44 +- 0.02 A, midway between a single and double bond, suggesting that both C atoms bond to the surface.

38024 **Application of the library least-squares analysis to whole-body counter spectra derived from an array of detectors.** Wielopolski, L.; Cohn, S.H. (Brookhaven National Laboratory, Medical Research Center, Upton, New York 11973). *Medical Physics;* **11**: No. 4, 528-533(Jul 1984). Contract AC02-76CH00016.

The library least-squares method was applied to the analysis of gamma-ray spectra obtained from an array of 54 NaI(Tl) detectors in a whole-body counter. The analysis of spectra which were obtained over a period of 8 yr demonstrates the applicability of the method despite inherent variations encountered in large counting systems. The elements of interest analyzed were total-body K, Ca, Na, Cl, and P. Least-squares fits obtained with library standards derived from distributed sources were better than those obtained from library standards derived from localized sources.

38025 **Role of reflectance in the photoacoustic spectra of copper, silver, and gold.** Hodul, D.; Carlson, K.D. (Chemistry Division and Division of Materials Science and Technology, Argonne National Laboratory, Argonne, Illinois 60439). *Applied Spectroscopy;* **38**: No. 2, 159-161(Mar 1984). Contract W-31-109-ENG-38.

The photoacoustic (PA) spectra were determined over the wavelength region of 1000-200 nm for polished and etched foils and powders of Cu, Ag, and Au. Aside from differences in signal strengths, problems with abnormal signal distortions due to reflection, and problems with surface oxidation in powdered Cu, the spectra were basically the same for the foils and powdered samples of the same metal. Analysis of the spectra showed that the PA signals were proportional to (1-R), where R is the regular reflectances of the metal. Thus, the PA spectra were essentially reflectance loss spectra.

38026 **Determination of cadmium in pure zirconium by inductively coupled plasma-atomic emission spectroscopy.** Jing, L.S.; Barnes, R.M. (Department of Chemistry, GRC Tower, University of Massachusetts, Amherst, Massachusetts 01003-0035). *Applied Spectroscopy;* **38**: No. 2, 284-285(Mar 1984). Contract AC02-77EV04320.

A procedure is described for the determination of cadmium in pure zirconium by inductively coupled plasma-atomic emission spetroscopy.(AIP)

38027 **Experimental study of deep bed filtration: A stochastic treatment.** Hsu, E.H.; Fan, L.T. (Dept. of Chemical Engineering, Kansas State Univ., Manhattan, KS 66506). *AIChE (American Institute of Chemical Engineers) Journal;* **30**: No. 2, 267-273(Mar 1984).

A stochastic pure birth process, which describes pore blockage in a filtration process, has been coupled with the Carman-Kozeny equation to simulate the pressure buildup in deep bed filtration. It has been shown that the resultant one parameter model equation fits adequately the experimental data obtained under the straining dominated condition, and that available data obtained under the adhesion dominated condition can also be described by the model.

38028 **Calculation of aerosol collection in fluidized filter beds.** Ushiki, K.; Tien, Chi. (Dept. of Chemical Engineering & Materials Science, Syracuse University, Syracuse, NY 13210). *AIChE (American Institute of Chemical Engineers) Journal;* 156-168(Jan 1984). Contract AC02-79ER10386.

A method is proposed for calculating aerosol collection in fluidized filter beds. The method employs the bubble assembly model of fluidization and considers the bed to be a series of compartments, each of which comprises two or three phases. Aerosol collection is assumed to occur in these phases in accordance with existing theories of particle deposition. The validity of the method is tested against available experimental data.

38029 **Ultratrace analysis of transuranic actinides by laser-induced fluorescence.** Miller, S.M. (to Dept. of Energy). US Patent Application 6-547,280. 31 Oct 1983. 32p. Contract W-7405-ENG-48.

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Ultratrace quantities of transuranic actinides are detected indirectly by their effect on the fluorescent emissions of a preselected fluorescent species. Transuranic actinides in a sample are coprecipitated with a host lattice material containing at least one preselected fluorescent species. The actinide either quenches or enhances the laser-induced fluorescence of the preselected fluorescent species. The degree of enhancement or quenching is quantitatively related to the concentration of actinide in the sample.

38030 **Analyses of construction materials by neutron-capture prompt γ-ray activation analysis.** Anderson, D.L.; Gordon, G.E. (Maryland Univ., College Park (USA). Dept. of Chemistry); Lepel, E.A. (Pacific Northwest Lab., Richland, WA (USA)). *Canadian Journal of Chemistry;* **61**: No. 4, 724-728(Apr 1983).

Neutron-capture prompt γ-ray activation analysis (PGAA) was used to measure concentrations of up to 18 elements in cement, sand, aggregate, and concretes and up to 9 elements in several types of steel. All major elements except oxygen are measurable in both types of samples. The observed elements, especially Ca and B, in concrete and its constituents allow one to determine the amount of cement used in the concrete, but additional elements would be needed to distinguish sand and aggregate.

38031 **Optimization and evaluation of packed capillary columns for high-performance liquid chromatography.** McGuffin, V.L.; Novotny, M. (Indiana Univ., Bloomington). *Journal of Chromatography;* **255**: 381-393(1983).

Packed capillary columns were systematically optimized for adsorption high-performance liquid chromatography, and their performance was evaluated using conventional plate height vs. linear velocity curves and the Knox separation impedance. Column performance was improved by decreasing the inner diameter, nominal

particle size, and mean pore size of the silica adsorbent. Irregularly shaped silica particles gave consistently higher efficiencies than spherical materials. The performance of packed capillary columns, as measured by the Knox separation impedance, is currently equal to or exceeds that of conventional or microbore packed columns. 22 references, 8 figures, 4 tables.

38032 **Determination of some polyaromatic compounds by reversed-phase liquid chromatography with electrochemical detection.** Caudill, W.L.; Novotny,M.V.; Wightman, R.M. (Indiana Univ., Bloomington). *Journal of Chromatography;* **261**: 415-418(1983). Contract AC02-81ER60007.

Cyclic voltammograms of 2-aminoanthracene, anthracene and acridine in acetonitrile with sodium perchlorate (0.1M) as supporting electrolyte at a glassy carbon electrode produced oxidation peak potentials 0.16 V, 0.82 V, and 1.17 V, respectively. Analysis of the relative peak potential differences indicates that liquid chromatography with electrochemical detection should be able to determine 2-aminoanthracene in the mixtures. A stable amperometric detector was constructed so that the mobile phase contacts only stainless steel, Tefzel, glassy carbon, and the reference electrode. For the analysis of very complex samples (coal tars and oil shale), the technique may provide valuable qualitative information in sample screening efforts. 16 references, 1 figure, 1 table.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 40020037403, 37406, 38064, 38070, 38725

38033 **(CONF-8409102—3) Cerium compounds in the fashion of the light actinides.** Koelling, D.D. (Argonne National Lab., IL (USA)). 3 Sep 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014642.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

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Researchers familiar with the light actinides easily recognize in cerium compounds a microcosm of the rich variety of properties seen in the light actinides. The parallelism seen between comparable cerium and actinide compounds strongly suggests that the same physical models are applicable. The most significant is the relative size of the f-orbital. Localization is generally tighter in Ce compounds than uranium compounds, making Ce roughly analogous to Np through Am. A way to see the actinide parallelism is to compare Hill plots. Compounds in the different regions of the plots (representing different physics) are isostructural compounds with the same companion (B) elements. The most common materials exhibiting a direct f-f interaction are the cubic Laves compounds. Accordingly, we have determined the band structures of $CeRu_2$, $CeRh_2$, $CeIr_2$, $CeOs_2$, and $CeNi_2$. Compounds illustrative of the interaction of f-orbitals with ligand orbitals are the Cu_3Au structured materials. Materials calculated in this class are $CeRh_3$, $CePd_3$, and $CeSn_3$ - the materials of much interest as mixed valent. Although the focus is on the Ce compounds, calculations performed on uranium isomorphs are used to highlight the interesting physics.

38034 **(INIS-mf—8394) Natural sulfur-38 - tracer for SO_2-oxidation.** Junkermann, W. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1980. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780264.

To determine the SO_2-degradation in the atmosphere the natural activity of argon-spallation product S-38 is used. During spring and summer 1980 $^{38}SO_2$-data were measured at different weather conditions. The production rate of S-38 in argon was determined in August 1980. The average life of SO_2 in the lower troposphere ranged between 10 minutes and several hours as was calculated by means of a onedimensional mixture model of the atmosphere. These SO_2-lifes are considerably shorter than those in literature with one until two days. (SPI).

38035 **(LBL—17852) Spectroscopic ellipsometry of Rhodamine-B adsorbed on platinum, silver and copper.** Farmer, J.C.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 6p. (CONF-840853—7). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014588.

From International Society of Electrochemistry; Berkeley, CA, USA (5 Aug 1984).

On Ag(111), the measurements indicate that the surface saturates with Rhodamine-B at a concentration of about 1.2 micromolar. Coverages close to 50% close packing were found with primarily normal orientation for Ag and mixed orientations for Pt and Cu. Two peaks are caused by the adsorbed dye on polycrystalline Pt, and interpretations are offered. (DLC)

38036 **(NIIAR—48(563)) Investigation into thermal conductivity of tungsten and uranium hexafluoride cryodeposits.** Barkov, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701518.

The requirements to the cryostat for studies of cryodeposits thermal conductivity of uranium hexafluoride and similar compounds have been considered. The cryostat design developed for cryodeposits thermal conductivity studies, the device instrumentation and its flowsheet as well as the experimental technique are described. The data of the thermal conductivity coefficient of the tungsten and uranium hexafluoride cryodeposits at 93-165 K are presented.

38037 **Reaction dynamics for $O(^3P)+H_2$ and D_2. IV. Reduced dimensionality quantum and quasiclassical rate constants with an adiabatic incorporation of the bending motion.** Bowman, J.M.; Wagner, A.F.; Walch, S.P.; Dunning, T.H. Jr. (Department of Chemistry, Illinois Institute of Technology, Chicago, Illinois 60616). *Journal of Chemical Physics;* **81**: No. 4, 1739-1752(15 Aug 1984). Contract W-31-109-ENG-38.

Reduced dimensionality exact quantum and quasiclassical reaction probabilities, transmission coefficients, and rate constants are presented for the $O(^3P)+H_2(v = 0,1)$ and $O(^3P)+D_2(v = 0,1)$ reactions on an effective potential surface given by the ab initio MOD POLCI potential energy surface reported previously plus the adiabatic ground state bending energy eigenvalue obtained from the two (nondegenerate) nonlinear potential energy surfaces reported here. The new rate constants are compared to experiment. Good agreement is found for thermal rate constants and isotope effects and for vibrationally excited rate constants.

38038 **Ab initio calculation of reaction energies. III. Basis set dependence of relative energies on the FH_2 and H_2CO potential energy surfaces.** Frisch, M.J.; Binkley, J.S.; Schaefer, H.F. III. (Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **81**: No. 4, 1882-1893(15 Aug 1984).

The relative energies of the stationary points on the FH_2 and H_2CO nuclear potential energy surfaces relevant to the hydrogen atom abstraction, H_2 elimination and 1,2-hydrogen shift reactions have been examined using fourth-order Moller—Plesset perturbation theory and a variety of basis sets. The theoretical absolute zero activation energy for the $F+H_2 \rightarrow FH+H$ reaction is in better agreement with experiment than previous theoretical studies, and part of the disagreement between earlier theoretical calculations and experiment is found to result from the use of assumed rather than calculated zero-point vibrational energies. The fourth-order reaction energy for the elimination of hydrogen from formaldehyde is within 2 kcal mol^{-1} of the experimental value using the largest basis set considered. The qualitative features of the H_2CO surface are unchanged by expansion of the basis set beyond the polarized triple-zeta level, but diffuse functions and several sets of polarization functions are found to be necessary for quantitative accuracy in predicted reaction and activation energies. Basis sets and levels of perturbation theory which represent good compromises between computational efficiency and accuracy are recommended.

38039 Statistical mechanical theory of chemically reacting multiphase mixtures: Application to the detonation properties of PETN. Ree, F.H. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Chemical Physics;* **81**: No. 3, 1251-1263(1 Aug 1984). Contract W-7405-ENG-48.

We present a new statistical mechanical theory of multiphase, multicomponent systems. It is based on Ross's modification of the Mansoori—Canfield—Rasaiah—Stell hard-sphere variational theory and the improved one-fluid van der Waals mixture model. Next, the new theory and exponential-6 potentials that accurately reproduce shock wave data of major detonation-product species are used to compute the detonation properties of PETN (pentaerythritol tetranitrate). The results show satisfactory agreement with the experimental Chapman—Jouguet (CJ) data at initial densities (rho_0) between 0.25 and 1.77 g/cm^3. Small (≃9%) deviations which occur between the experimental and the theoretical CJ pressures at high rho_0 (>1.55 g/cm^3) are attributed to time-dependent processes associated with formation of solid carbon which is theoretically present in detonation products. We suggest that some CJ pressure experiments might have finished too soon to experimentally observe late-time reactions involved in formation of solid carbon. However, a more definitive conclusion must await further effort to reduce experimental and theoretical uncertainties in the CJ pressure. We have also compared the theoretical CJ expansion adiabat at rho_0 = 1.77 g/cm^3. The present theory predicts that both the adiabatic gamma -(partial ln P/partial ln V)/sub s/ and the Grueneisen gamma exhibit peaks, along the CJ adiabat, at the density range where carbon atoms in gaseous detonation products start to condense.

38040 Electron—ion recombination in gas mixtures of helium, nitrogen, and carbon dioxide. Littlewood, I.M.; Cornell, M.C.; Nygaard, K.J. (University of Missouri-Rolla, Rolla, Missouri 65401). *Journal of Chemical Physics;* **81**: No. 3, 1264-1270(1 Aug 1984).

A study has been conducted to determine the electron—ion recombination rates in gas mixtures of helium, nitrogen, and carbon dioxide. Measurements were made as functions of electric field strength, gas pressure, and gas composition. In gas mixtures containing only nitrogen and carbon dioxide, the rates were dependent on pressure. This dependence is interpreted as being due to the separate effects of two- and three-body recombination processes. No pressure dependence was observed for mixtures containing helium. In such mixtures, two-body recombination appears to be dominant. Moreover the addition of relatively low concentrations of helium to the discharge leads to a dramatic change in the bulk recombination rate. Two possible explanations for this observation are suggested.

38041 Formation of new acid sites in dilute oxide solid solutions: a predictive model. Kung, H.H. (Northwestern Univ., Evanston, IL). *Journal of Solid State Chemistry;* **52**: No. 2, 191-196(Apr 1984).

A predictive model for the formation of new acid sites in a dilute solid solution of two component oxides is being developed by examining the electrostatic potential at the substituting cation site and the changes in the matrix necessary to balance the stoichiometry. When the prediction was used to compare with experimental results, the satisfactory comparison suggests that the electrostatic potential and the balance of stoichiometry are the two dominant factors in new acid site formation. The implications of this are discussed.

38042 Fate of solids fed pneumatically through a jet into a fluidized bed. Kececioglu, I.; Keairns, D.L.; Yang, W.C. (Westinghouse Research & Development Center, Pittsburgh, PA 15235). *AIChE (American Institute of Chemical Engineers) Journal;* 99-110(Jan 1984). Contract AC01-76ET10161.

Solid tracer particles were fed pneumatically through a jet into a fluidized bed to simulate the feeding of solids via a pneumatic transport line into a fluidized-bed reactor operating in the slugging-bed mode. The fluidized bed was defluidized instantaneously at different times after the initiation of the tracer particle injection. The bed was then sampled layer by layer to provide the radial and axial concentration profiles of the tracer. Regular and high-speed movies (1,000 frames per second) were taken to study the operation of the fluidized bed and the phenomena of the gas-solid two-phase jet. Experimental results on solid mixing, jet constriction and slugging frequencies, slugging bed height, slug length, jet penetration, and jet half-angle at three nominal jet velocities of 52, 37, and 25 m/s and corresponding solids loadings are presented. Additional experimental results on jet constriction and slugging frequencies, and slug volume (axial slug size) obtained for a wider range of jet velocities confirm the hydrodynamic trends observed during the tracer particle injection experiments. The results indicate that solids mixing increases, and well-mixed conditions are reached earlier, with an increase in jet injection velocity. The obtained mixing times were correlated successfully in terms of the excess gas velocity. The experimental data on jet penetration and slug motion were satisfactorily correlated by modified versions of existing theoretical relations. The modifications included the effect of the injected solids on jet penetration and jet half-angle and also the effect of our semicircular column geometry and single wall-slug configuration on the observed slug motion.

38043 Rate processes in cycling a reversible gas-solid reaction. Stanish, M.A.; Perlmutter, D.D. (Dept. of Chemical Eng., Univ. of Pennsylvania, Philadelphia, PA 19104). *AIChE (American Institute of Chemical Engineers) Journal;* 56-61(Jan 1984). Contract FG02-80CS84051.

Rate studies are reported of the effect of rehydration-dehydration cycling on the vapor hydration behavior of solid K_2CO_3. Isothermal rate data were obtained at different temperatures and water vapor pressures for the reaction of narrowlysized anhydrous particles. Effects of different particle preparation histories on the rehydration rate were investigated and correlations of rate with particle pore structure explored. Rehydration rates of dehydrated K_2CO_3 X 3/2H_2O were found to depend on the conditions of the prior dehydration. Rehydration is comparatively very slow at relative pressures below P/P/SUB eq/ about 1.5; rates increase linearly with pressure above P/P/SUB eq/ about 3. Hydration rates of K_2CO_3 particles obtained as anhydrous are substantially slower than those of identically-sized crystals produced by prior dehydration of K_2CO_3 X 3/2H_2O; after one rehydration-dehydration cycle, rehydration rates are increased by as much as two orders of magnitude and this distinction between sources virtually disappears. Diffusional resistances based on calculated water vapor diffusivities are qualitatively consistent with the observed effects of cycling but do not by themselves account fully for the observations.

38044 Effect of potassium on the catalyzed reactions of n-hexane over Pt(111) single crystal surfaces. Zaera, F.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). *Journal of Catalysis;* **84**: 375-385(1983). Contract AC03-76SF00098.

The effect of potassium on the n-hexane conversion catalyzed by Pt(111) single crystals has been studied near atmospheric pressures. Reaction activity, selectivity, and self-poisoning with time were studied as a function of potassium coverage of the crystal faces. The activity of the catalyst dropped drastically with as little as 2% potassium atoms on the surface, with no improvement in selectivity or stability. The temperature dependence in the range 550-625 K of the reaction rates was not significantly different from the clean platinum case. The changes in the structure of the carbonaceous deposits formed during the reaction have also been studied. The amount of carbon on the surface after reactions was slightly higher on the platinum surface that was covered with 2% potassium atoms, as compared with the clean platinum case. The amount of bare platinum available for reaction, however, increase by a factor of 2 when theta/sub K/ = 0.3. When potassium was added to the platinum surface, the carbonaceous deposits showed a higher hydrogen content, with a higher activation energy for its desorption, an increase up to 4 kcal/mol more than for the clean platinum case. The inhibition of the dehydrogenation of adsorbed hydrocarbon species in the presence of coadsorbed potassium on the platinum surface explains the changes of reactivity that are reported. 22 references, 10 figures, 2 tables.

38045 Moessbauer spectroscopy of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) metal center. Moore, K.J.; Lee, L.; Petersen, J.D. (Clemson Univ., SC). *Inorganic Chemistry;* **22**: No. 8, 1244-1246(1983). Contract AS09-80ER10671.

The lack of correlation of the photochemistry of the monometallic Fe(II) and Ru(II) systems with that of their bimetallic counterparts led to the studies reported. Moessbauer spectroscopy was used as a tool to assess whether d-orbital participation of the remote metal centers bound to pentacyanoferrate was responsible for the anomalous photochemical results previously observed. The complexes are listed according to descending frequency of the maximum of the Fe(II) → L charge-transfer(MLCT) transition. The ligands are pyridine(py), CN-pyRhIII$(NH_3)_5$, NC-pyCoIII$(CN)_5$, pyrazine(pz), 4,4'-bipyridine(bpy)CoIII$(CN)_5$, 4,4'-bpyRhIII$(NH_3)_5$, pzCoIII$(CN)_5$, pzRhIII $(NH_3)_5$, and N-methylpz. Isomer shifts and quadrupole splitting are shown for both 298° and 77°K spectra. The same trends are observed for the data at both temperatures. The authors concluded that the remote metal center may be treated as an electron-withdrawing substituent on the bridging ligand. Some subtle differences exist in the roles of $Rh(NH_3)_5^{3+}$ and $Co(CN)_5^{3-}$ metal centers in the back-bonding ability of L, but these factors do not explain the aforementioned discrepancies. 18 references, 1 table.

38046 Moessbauer studies of $REFe_2Si_2$ (RE = Gd-Lu) compounds. Noakes, D.R.; Umarji, A.M.; Shenoy, G.K. (Argonne National Lab., IL). *Journal of Magnetism and Magnetic Materials;* **39**: 309-316(1983).

Magnetic transition temperatures and results of ^{57}Fe, ^{155}Gd, ^{166}Er and ^{170}Yb Moessbauer effect studies of $REFe_2Si_2$ compounds are presented. The ^{57}Fe Moessbauer effect establishes that Fe never has a magnetic moment in these materials. Line broadenings seen in low temperature ^{57}Fe spectra are attributed to polarization of conduction electrons at the Fe site due to rare-earth magnetic ordering (or slow relaxation). The lattice-generated electric field gradient at the RE site, deduced from the ^{155}Gd quadrupole interaction in $GdFe_2Si_2$, is used to produce a crystalline electric field model for the magnetic behavior of the other members of this isostructural series. This model is instrumental in understanding the ^{166}Er Moessbauer effect in $ErFe_2Si_2$ and ^{170}Yb Moessbauer effect in $YbFe_2Si_2$.

38047 Hydrogen bond formation and anion ordering in superconducting $(TMTSF)_2ClO_4$ and $(TMTSF)_2AsF_6$. Beno, M.A.; Blackman, G.S.; Leung, P.C.W.; Williams, J.M. (Argonne National Lab., IL). *Solid State Communications;* **48**: No. 2, 99-103(1983). Contract W-31-109-ENG-38.

An examination of the low temperature (125K) X-ray diffraction determined structure of $(TMTSF)_2ClO_4$, the only ambient pressure organic superconductor known, reveals a previously unseen nearest-neighbor hydrogen bonding environment surrounding the anion resulting in short oxygen atom to methyl-hydrogen atom interactions that are likely responsible for the ordering of the ClO_4^- anion associated with a transition observed at 24K. Superconductivity is observed in $(TMTSF)_2ClO_4$ only when the anions adopt an ordered (relaxed) configuration. In contrast to the previously reported single short Se - O distance, the O - H-C contacts are both short and numerous. The observed librational motion of the perchlorate anion provides further support for the importance of the O - H interactions in the pinning of the anion. Additional discussion regarding the influence of F -H hydrogen bonds on the AsF_6^- anion disorder in $(TMTSF)_2AsF^6$, a superconductor under applied pressure only, is also presented.

38048 Multiphoton-induced fluorescence and ionization of B^1u^+ carbon monoxide. Loge, G.W.; Tiee, J.J.; Wampler, F.B. (Los Alamos National Lab., NM). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **380**: 402-405(1983).

From Los Alamos conference on optics '83; Los Alamos, NM, USA (1983).

The $B^1\Sigma^+$ state of carbon monoxide was created by a two-photon absorption of 230-nm laser radiation. The $B^1\Sigma^+$ state was identified by the position of the O-O absorption band Q-branch and the vibrational bands of $B^1\Sigma^+$ yields A^1PI fluorescence occurring in the 525-nm region. Collision induced $b^3\Sigma^+$ yields a^3PI emission in the 350-nm region was also seen. The lifetime of both the $B^1\Sigma^+$ state and the $b^3\Sigma^+$ state were measured as well as the self-quenching rate constant and the $B^1\Sigma^+$ quenching rate by N_2. In addition to the two-photon induced flourescence of $B^1\Sigma^+$ carbon monoxide, a three-photon ionization was observed. Laser power dependence studies indicate that ionization of the $B^1\Sigma^+$ state is easily saturated, implying that fluorescence is a minor process. Measurement of the polarization ratio of absorption for circular and linear polarized excitation of fluorescence and ionization suggests that another three-photon process is occurring and occurs more effciently for linear polarization.

38049 Multiphoton laser-induced fluorescence studies of simple species. Tiee, J.J.; Ferris, M.J.; Loge, G.W.; Wampler, F.B. (Los Alamos National Lab., NM). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **380**: 406-410(1983).

From Los Alamos conference on optics '83; Los Alamos, NM, USA (1983).

Recent studies have demonstrated multiple-photon excitation of atomic species. Bischel and coworkers have provided a detailed description of two-photon excitation fluorescence in the detection of atoms generated in a low pressure discharge and its possible application as a diagnostic tool in flame and plasmas. It is also believed that such techniques can be useful in detecting molecular transients which are difficult to detect otherwise as demonstrated in two-photon laser-induced fluorescence (LIF) detection of NO. In this paper, recent two-photon LIF studies on I and Br atoms are discussed, which are produced via laser photolysis of molecular precursors. The two-photon LIF study of HS and DS radicals is presented as a test case for the detection of other important radical species such as C_2H and CH_3, which are currently being investigated in the laboratory. In addition, excitation of three-photon resonances of I_2, N_2, and H_2 is discussed.

38050 Comments on the cis, trans, and cyclic dimers of NO. Ritchie, J.P. (Los Alamos National Lab., NM). *Journal of Physical Chemistry;* **87**: No. 14, 2466-2468(1983).

Geometry optimizations and force constant calculations have been performed at various levels of theory for the cis, trans, and cyclic isomers of NO. Even at levels including d orbitals, the calculated geometries and relative energies of the cis and trans isomers show substantial errors. Sigma-aromaticity may play a role in stabilizing the cis isomer. The cyclic structure is verified as a minimum at the SCF level by the calculation of force constants; MINDO/3 and volume calculations lend support to the suggestion that it may involved in the detonation of NO. 18 references, 2 tables.

38051 Optical properties of explosive-driven shock waves in Noble gases. Jones, C.R.; Davis, W.C. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 312-321(1983).

High explosives have been used to shock-heat rare gases to brightness temperatures up to 36,000 K, with large radiating areas. Temperatures were determined from radiometer signals at both 280 and 520 nm. Shock velocities up to 9 mm/μs were used in both plane and cylindrical geometries. Neon, argon, krypton, and xenon gases at atmospheric initial pressure were examined in plane shocks. Using argon, the effects of increased initial pressure were studied. For cylindrical shock expansion in argon, brightness temperatures were measured over a range of shock velocities from 3 to 9 mm/μs. Up to 4% of the explosive energy was emitted as radiation. The shock waves are found to be reasonable approximations to blackbodies. 10 references, 9 figures, 3 tables.

38052 Novel palladium(II)-catalyzed copolymerization of carbon monoxide with olefins. Sen, A.; Lai, T.W. (Pennsylvania State Univ., University Park). *Journal of the American Chemical Society;* **104**: No. 12, 3520-3522(1982). Contract AC02-81ER10992.

The catalyst, $[Pd(CH_3CN)_4](BF_4)_2$.n-triphenylphosphine n = (1-3), demonstrated the capacity to mediate the copolymerization of CO with ethylene and other alkenes under very mild conditions. The reaction of ethylene (350 psi), dissolved in acetonitrile, and

CO(350 psi) was performed at 25°C for 1 d. The copolymerizations of CO(800 psi) with norbornadiene and norbornylene were performed at 60°C. The structures of the copolymers were studied by NMR. 9 references, 1 figure.

38053 **PMR spectroscopic studies of lanthanide aminocarboxylate complexes.** Choppin, G.R.; Baisden, P.A.; Rizkalla, E.N. (Florida State Univ., Tallahassee). pp 187-191 of Rare earths in modern science and technology. Vol. 3. McCarthy; Silber; Rhyne (eds.). New York, NY; Plenum Publishing Corporation (1982).

Uncertainty exists concerning the nature of the chelation of ethylenediamine-tetraacetic acid (EDTA) with lanthanides. NMR spectra of its complexes with calcium, (Ca), lanthanum (La), yttrium (Y), lutetium (Lu) were measured at 0, 30, 85°C in D_2), pH 7 - 9. For the complexes, an AB quartet pattern was observed for the acetate protons over the temperature range studied with the exception of the calcium complex at 85°C, which produced a broadened singlet. The ethylenic protons all produced a singlet, and that of the baricenter of the acetate quartet agreed with earlier experimental values and showed no significant temperature dependence. The separation of the 2 inner peaks of the quartets were at room temperature (Hz): Ca, 4.9 La, 5.4; Y, 43; Lu, 49. For all the complexes, this separation decreased with increasing temperature. The observation of a quartet in these high resolution spectra confirms that both nitrogen donors are bonded and all 4 carboxylate groups are equally bonded in CaEDTA as well as in the lanthanide-EDTA complexes. 1 figure.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 40030037174, 37409, 37830, 38045, 38052, 38053, 38077, 38085, 38398

38054 **(CONF-820575—10) Electron reactions in model liquids and biological systems.** Bakale, G.; Gregg, E.C. (Case Western Reserve Univ., Cleveland, OH (USA)). 1982. Contract AC02-78EV04746. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013120.

From 15. annual radiological physics contractors meeting; Gettysburg, PA, USA (4 May 1982).

Progress is reported in the following studies: (1) Field-dependent electron attachment; (2) Dependence of electron attachment rate on electron-acceptor dipole moment; (3) Electron attachment in i-octane/TMS mixtures; (4) Electron attachment/detachment equilibria; (5) Electron attachment to reversed micelles; (6) Electron attachment to chemical carcinogens; (7) Radiation-induced bacterial mutagenesis; and (8) Bacterial mutagenicity of nitrobenzene derivatives. 14 references. (ACR)

38055 **(DOE/SF/11653—T11) Thermodynamic properties of isobutane-isopentane mixtures from -40 to +600°F and up to 1000 psia.** Gallagher, J.S.; Levelt Sengers, J.M.H.; Morrison, G.; Sengers, J.V. (National Bureau of Standards, Washington, DC (USA). Thermophysics Div.; Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). Jul 1984. Contract AI03-82SF11653. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84015137.

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The Helmholtz function for pure isobutane from a recent correlation has been converted to a dimensionless form and a pressure-enthalpy chart based on this function has been generated by computer. A Helmholtz function for mixtures of isobutane and isopentane has been formed based upon the dimensionless isobutane Helmholtz function as the reference fluid by means of an extended corresponding-states principle. Scarce literature data for saturation properties of isopentane, and new data for its vapor pressure and for the critical line of the mixture were used. The accuracy of the surface was checked by comparing with literature enthalpy data and with new VLE data for the mixture. Tables of thermodynamic properties have been generated from this Helmholtz function for the 0.1 mole fraction isopentane-in-isobutane mixture in the single-phase region and on the dew- and bubble-point curves, together with properties of the coexisting phase. A pressure-enthalpy chart for this mixture has also been generated.

38056 **(IEA/EAS—E5) Ethylene production from oil, gas and coal-derived feedstock.** Stratton, A.; Hemming, D.F.; Teper, M. (IEA Coal Research, London (UK). Economic Assessment Service). Nov 1983. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84901382.

Ethylene and the associated olefins, propylene and butadiene, are the basic feedstock for the petrochemicals industry. Worldwide ethylene production is around 40 million metric tons a year, valued at some 20 billion dollars. The wide range of products from these olefins suggests that the markets for these products, and hence demand for olefins, will increase. Ethylene is now almost exclusively produced by the cracking (pyrolysis) of a wide range of hydrocarbon feedstocks, namely ethane, LPG, naphtha and gas-oil (middle distillate). In the long-term, with declining availability of these hydrocarbons, ethylene from coal could become a possible alternative. Ethylene can also be produced by the dehydration of ethanol (ethyl alcohol) produced by fermentation. This report compares the cost of producing ethylene by cracking natural gas or oil-derived feedstocks, with dehydration of methanol. The report also comments on the future prospects of using coal as raw material for ethylene production, via methanol. The economics of the route to ethylene via methanol depend both on the cost of methanol from the basic feedstock, natural gas or coal, and on the value placed on methanol as a fuel. To show how coal and naphtha compete as a feedstock for ethylene, the report gives graphs showing the preferred feedstock for any given set of coal and naphtha prices. There are other possible ways of making ethylene from coal which are considered briefly. 34 references, 10 figures, 15 tables.

38057 **(JINR—R-12-82-539) About possible nature of univalent astatine cation entering the electrophilic aromatic substitution in heterogeneous medium in the presence of acids.** Vasharosh, L.; Norseev, Yu.V.; Nyan, D.D.; Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701512.

It has been shown that for 15-20 min. of heating at 180-190 deg C, astatobenzene is formed with the yields of above 90% in the systems of benzene-astatine-solution in $HClO_4$ or H_2SO_4. Activation energy of the astatination process was found to be (32+-2) Kcal./Mole. Protonated hypoastatic acid - $(H_2^+OAt)^+$ formed in aqueous acidic solutions was supposed to be responsible for the electrophilic astatination reaction with benzene and its halogen-derivatives.

38058 **(LBL—17798) Surface chemistry of palladium.** Gentle, T.M. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 415p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84014572.

Portions are illegible in microfiche products; Thesis.

Several classes of catalytically important molecules on Pd single crystals were studied. Influence of surface structure and composition on reactions involving formation and scission of carbon-carbon and carbon-hydrogen bonds was investigated under uhv conditions on single crystals and higher pressures on polycrystalline films. Reactions of acetylene on Pd(111), Pd(100), and Pd(110) were studied using thermal desorption spectroscopy, chemical displacement reactions, and isotopic labeling techniques. Pd single crystals catalyzes trimerization to benzene, hydrogenation to ethylene, and hydrosilation with trimethylsilane. Several atoms such as Si, P, S, and Cl have a profound influence on the catalysis. Single-crystal Pd surfaces catalyzes the dehydrogenation of organosilanes; silacyclohexane chemisorbed on Pd(110) underwent dehydrogenation upon thermal desorption to form silabenzene. Desulfurization products were observed in the thermal desorption spectra chemisorbed thiophene, 3-methylthiophene, and 2,5-dimethylthiophene. Mechanisms of carbon-hydrogen bond scission were investigated for a variety of methyl-substituted benzenes, revealing some degree of regiospecificity in C-H bond scission. Several reactions of unsaturated hydrocarbons were also investigated at higher pressures (10^{-3} torr) on polycrystalline Pd films.

38059 **Influence of crystal fields on the quasimetallic reflection spectra of crystals: Optical spectra of polymorphs of a squarylium dye.** Tristani-Kendra, M.; Eckhardt, C.J. (Department of Chemistry, University of Nebraska-Lincoln, Lincoln, Nebraska 68588-0304). *Journal of Chemical Physics;* **81**: No. 3, 1160-1173(1 Aug 1984). Contract FG02-79ER10535.

The reflection and Kramers—Kronig absorption spectra have been obtained from the monoclinic and triclinic polymorphs of a squarylium dye, 2,4-bis(4-diethylamino-2-hydroxy phenyl) cyclobutadienediylium-1,3-diolate. The extremely different optical responses were found to arise from two molecular singlet transitions of essentially long axis polarization. Successful application of a four oscillator molecular exciton—polariton theory required the use of point charge densities rather than point dipoles in an extension of the theory which employed both interactions between the two singlets as well as a frequency dependent lattice damping. An intermolecular charge transfer transition is also assigned.

38060 **High-resolution electron energy loss spectroscopy study of the surface structure of benzene adsorbed on the rhodium(111) crystal face.** Koel, B.E.; Crowell, J.E.; Mate, C.M.; Somorjai, G.A. (Univ. of California, Berkeley). *Journal of Physical Chemistry;* **88**: No. 10, 1988-1996(10 May 1984).

Benzene adsorption on the Rh(111) crystal surface has been studied by HREELS (high-resolution electron energy loss spectroscopy), LEED (electron diffraction), and TPD (temperature programmed desorption). The vibrational spectra indicate that benzene adsorbs molecularly at 300 K and is π-bonded to the surface with the ring plane parallel to the surface plane. Recent dynamic LEED calculations together with the angle-dependent HREELS studies reported here establish a C/sub 3v/(σ/sub d/) bonding symmetry for the c(2$\sqrt{3}$ x 4)rect-C_6H_6 structure. Several other ordered benzene overlayers can be formed between 300 and 400 K depending on the benzene coverage. No large changes occur in the chemisorption bonding mode or geometry coincident with the two-dimensional ordering phase transitions in this temperature range. The vibrational spectra show that two molecular adsorption sites can be populated. Benzene adsorption is only partially reversible; less than 20% of the adsorbed benzene desorbs molecularly upon heating. The remaining benzene irreversibly decomposes, evolving hydrogen and leaving a carbon-covered surface. The TPD and HREELS data on Rh(111) and other single-crystal surfaces show correlations between the metal-benzene bond strength, the work function of the clean surface, and the frequency shifts of some of the molecular benzene vibrational modes. 44 references, 10 figures, 4 tables.

38061 **Model for thermodyamics of ionic surfactant solutions. 1. Osmotic and activity coefficients.** Burchfield, T.E.; Woolley, E.M. (Bartlesville Energy Tech. Center, OK). *Journal of Physical Chemistry;* **88**: No. 10, 2149-2155(10 May 1984).

Equations have been derived for activity coefficients and osmotic coefficients of aqueous ionic surfactant solutions. The equations are based on a mass-action model with a single micellar aggregate species. The micellar solution is treated as a mixed electrolyte by using the Guggenheim equations. A shielding factor is included to account for screening of the micellar charge. The equations have been applied to experimental data for aqueous solutions of ionic surfactants. Osmotic and activity coefficient data from 0 to 50°c and from 0.001 to 4 mol kg^{-1} have been correlated with the equations using a maximum of two ion-ion interaction parameters. Data for several surfactants have been described up to 1 mol kg^{-1} using no ion-ion interaction parameters. 50 references, 7 figures, 3 tables.

38062 **Correlation of zero-point energy with molecular structure and molecular forces. 3. Approximation for H/D isotope shifts and linear frequency sum rule.** Oi, T.; Ishida, T. (State Univ. of New York, Stony Brook). *Journal of Physical Chemistry;* **88**: No. 10, 2057-2061(10 May 1984). Contract AC02-80ER10612.

The approximation methods for the zero-point energy (ZPE) previously developed using the Lanczo's tau method have been applied to the shifts in ZPE due to hydrogen isotope substitutions. Six types of approximation methods have been compared and analyzed on the basis of a weighing function $\Omega(\lambda)$ varies as λ/sup k/ and the actual eigenvalue shift spectra. The method generated by the most general optimzation treatment yields a predictable and generally satisfactory precision of the order of 1% or better. A linear frequency sum rule has been derived, which approximately holds for the sets of isotopic molecules which satisfy the second-order frequency sum rule. 19 references, 3 figures, 3 tables.

38063 **Ultraviolet absorption spectrum of peroxyacetyl nitrate and peroxypropionyl nitrate.** Senum, G.I.; Lee, Y.N.; Gaffney, J.S. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **88**: No. 7, 1269-1270(29 Mar 1984). Contract AC02-76CH00016.

The UV absorption spectrum was measured for peroxyacetyl nitrate (PAN) and peroxypropionyl nitrate (PPN) at 298 +/- 1 K in the 200-400-nm wavelength region. From this, the absorption cross sections for PAN and PPN have been calculated. Solar photolysis rates for PAN and PPN are estimated on the basis of the measured and extrapolated cross sections. 2 tables.

38064 **Critical point measurements on nearly polydisperse fluids.** Morrison, G.; Kincaid, J.M. (Thermophysics Division, Nat'l. Bureau of Standards, Washington, DC 20234). *AIChE (American Institute of Chemical Engineers) Journal;* **30**: No. 2, 257-262(Mar 1984).

The critical temperatures, pressures and volumes of several mixtures containing CO_2, C_2H_6, C_3H_8, and C_4H_{10} have been measured using a heavy walled, variable volume, cylindrical glass vessel. In each mixture the relative proportions of the three hydrocarbon solutes to one another were changed; total solute mole fraction never exceeded 0.1. A detailed study of the mixture CO_2 + C_3H_8 shows that the critical temperature exhibits a minimum at a C_3H_8 mole fraction of 0.0265. Our mixture data are analyzed using a polydisperse model of dilute solutions.

38065 **Photoconductivity induced by single-proton excitation of aromatic molecules in liquid hydrocarbons.** Holroyd, R.A.; Preses, J.M.; Boettcher, E.H.; Schmidt, W.F. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **88**: No. 4, 744-749(16 Feb 1984).

The spectral dependence of the photoconductivity of several aromatic solutes (anthracene, 1,2-benzanthracene, perylene, pyrene, azulene, α-methylnaphthalene, and triphenylamine) in liquid hydrocarbon solvents (neopentane, 2,2,4-trimethylpentane(2,2,4-TMP), 2,2,4,4-tetramethylpentane (2,2,4,4-TMP), and n-pentane) are reported. In liquids which exhibit high thermal electron mobilities, relative maxima or shoulders are detected in the photoconductivity spectra. The corresponding transitions are thought to involve the formation of Rydberg states as precursors of separated charges. For anthracene and azulene, the transitions occur at approximately the same energy where Rydberg lines are observed in the gas phase. Quenching of the photoconductivity by perfluoromethylcyclohexane and by perfluoro-n-hexane supports this hypothesis.

38066 **Methylation of platinum by methylcobalamin.** Taylor, R.T.; Hanna, M.L. Livermore, CA; University of California (1984). 16p.

From Biological implications of metals in the environment; Richland, WA (Sep 1975).

Incubation of micromolar levels of potassium hexachloroplatinate (K_2PtCl_6) and methylcobalamin (MeB-12) results in the complete conversion of MeB-12 to aquocobalamin (aquoB-12). Demethylation is optimal at approximately pH 2.0 and is accelerated by the addition of potassium tetrachloroplatinate (K_2PtCl_4). The reaction is stoichiometric between MeB-12 and the K_2PtCl_6 added (1:1). Isosbestic points at 492, 367, and 335 nm during the course of the reaction indicate that MeB-12 is demethylated to aquoB-12 with no accumulation of corrinoid intermediates. Higher alkylcobalamins and methylcobinamide react at much slower rates compared with MeB-12. Incubation of 40μM K_2 $PtCl_6$ with either 40μM [Me-^{14}C]MeB-12 or [Me-^{3}H]MeB-12 followed by lyophilization converts 70% of the label to a stable form that is associated with platinum upon subsequent paper chromatography and electrophoresis. There is no preferential loss of ^{3}H relative to ^{14}C in the reaction product. Difference spectra indicated that the platinum reaction

product had an absorption maximum at 260 nm. When 50 μmoles each of [Me-^{14}C]MeB-12 and K_2PtCl_6 were reacted and subjected to Sephadex G-15 chromatography, the ^{14}C label eluted with 260 nm of absorbing material. Further chromatography on Sephadex G-15 and CM-cellulose yielded a labeled ultraviolet-absorbing product with a ^{14}C/Pt ratio of 1.2. The overall recovery was 36 to 42% on the basis of the ^{14}C. The ^{14}C-Pt product has absorption maximums at 260 nm and 208 nm, with a minimum at 240 nm (A_{240} nm/A_{260} nm = 0.5). Proton-nuclear magnetic resonance (NMR) spectroscopy confirmed the presence of an H-C-Pt covalent bonding pattern (J for ^{1}H, ^{195}Pt = 78.2 Hz; tau for ^{194}Pt-Me + ^{196}Pt-Me = 6.956).

38067 **Condensation film coefficients for mixtures of isobutane and isopentane.** Tieimat, B.W.; Dizon, G.V.; Laird, A.D.K.; Rie, H.; Zhao, S. (Water Thermal and Chemical Technology Center, University of California, Berkeley). *Journal of Energy;* **7**: No. 6, 470-475(Nov 1983).

Presented herein are data on heat-transfer film coefficients for the condensation of 90/10, 80/20, 70/30, 60/40, and 50/50 mole-% isobutane/isopentane. For comparison, data on condensation of instrument-grade and commercial-grade isobutane are also presented. The vapor was condensed on the outside of a horizontal instrumented tube with cooling water flowing inside the tube. The tube was fitted with thermocouples imbedded inside the wall of the tube to measure tube wall temperature at five equidistant stations along the length of the tube. The vapor temperature in the shell was measured using 17 thermocouples located at 150 mm intervals and spanning the five stations. Results for the data taken, based on the difference between vapor temperature and wall temperature, indicate lower condensation film coefficient when the mole fraction of isopentane is increased in the mixture. Mole-percent values of isopentane <50% would be expected to reverse this trend.

38068 **Synthesis of alkylated indanes and tetralins for use in fossil fuel analysis.** Watt, D.S.; Adanczyk, M.; Netzel, D.A. (Department of Chemistry, University of Wyoming and Department of Energy, Laramie Energy Technology Center Laramie, Wyoming 82070). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **28**: No. 4, 292(Aug 1983). (CONF-830814—).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The availability of authentic hydrocarbon samples in the substituted indane and tetralin families would facilitate the analysis of certain fossil fuel mixtures. The authors have developed general procedures for the efficient preparation of simple alkylated indanes 1/sub -/ tetralins 2/sub -/ from common precursors. The authors have examined the ^{13}C NMR and mass spectral fragmentation data for hydrocarbons 1/sub -/ and 2/sub -/ in detail.

38069 **^{14}N NMR study of tetraalkylammonium compounds in the solid state.** Pratum, T.K.; Klein, M.P. (Lawrence Berkeley Lab., CA). *Journal of Magnetic Resonance;* **53**: 473-485(1983). Contract AC03-76SF00098.

The ^{14}N NMR powder patterns of various quaternary ammonium salts have been measured over the temperature region 155 to 273°K. Some of the spectra are dominated by motion, while others appear to arise from a rigid lattice; from the latter, values of the quadrupole coupling constant (e^2qQ) and the asymmetry parameter eta are determined. The quadrupole coupling constants fall in the range commonly observed for deuterium, while the asymmetry parameters take on virtually all possible values from 0 to 1. For some compounds the parameters appear to derive completely from lattice (crystalline field) effects, while for others there is probably a combination of lattice and intramolecular effects. 46 references, 5 figures, 1 table.

38070 **In situ laser Raman spectra of iron phthalocyanine adsorbed on copper and gold electrodes.** Melendres, C.A.; Rios, C.B.; Feng, X.; McMasters, R. (Argonne National Lab., IL). *Journal of Physical Chemistry;* **87**: No. 18, 3526-3531(1983).

Raman spectra of iron phthalocyanine (FePc) and its tetrasulfonated derivative (FeTSPc) adsorbed on copper and gold electrodes have been observed in situ in 0.05 M H_2SO_4 solution. Results confirm the authors previous finding on the coordination of FePc to water molecules to solution. Evidence suggests that the iron phthalocyanines are probably oriented with their planes parallel to the electrode surface even in immersed electrodes. A decrease in intensity and broadening of some vibrational bands are observed on increasing cathodic polarization; these are attributed to a lifting of the degeneracy of the vibrational modes due to a change in symmetry of the adsorbed molecules brought about by polarization induced by the double-layer field. The effect of carbon on the Raman spectra is discussed. The iron phthalocyanines appear to be stable at potentials close to hydrogen evolution in the absence of oxygen. 18 references, 8 figures.

38071 **Preparation and characterization of β-D-glucosidase immobilized in calcium alginate.** Woodward, J.; Krasniak, S.R.; Smith, R.D.; Spielberg, F.; Zachry, G.S. (Oak Ridge National Lab., TN). *Biotechnology and Bioengineering Symposium;* **12**: 485-489(1982). Contract W-7405-ENG-26.

The immobilization of enzymes, organelles, and microbial cells within calcium alginate gel spheres has been reported. Few reports exist, however, on the use of these spheres for enzyme immobilization. The study reported here describes the immobilization of β-D-glucosidase within calcium alginate gel spheres and addresses the problems of loss of enzyme activity in the spheres via inhibition and leakage.

38072 **Catalytic polymerization of acetylkenes and olefins by tetrakis(acetonitrile)palladium(II) bis(tetrafluoroborate).** Sen, A.; Lai, T.W. (Pennsylvania State Univ., University Park). *Organometallics;* **1**: No. 2, 415-417(1982). Contract AC02-81ER10992.

The cationic Pd(II) compound $[Pd(CH_3CN)_4](BF_4)_2$ was found to catalyze the polymerization of H-C identical with C-R (R = Ph, COOMe), styrene, α-methyl-styrene, 1,3-cyclohexadiene, norbornylene, and norbornadiene under very mild conditions. The polyacetylenes are highly colored and have relatively high molecular weights. The poly(phenylaceylene) has a transconfiguration around the C=C bond. The polymerization of 1,3-cyclohexadiene leads predominantly to the 1,2 polymer with only minimal crosslinking. The norbornane framework is retained during the polymerization of norbornylene. The poly(norbornadiene) is a highly crosslinked material. 17 references, 2 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 40040037737, 38032, 38070

38073 **(DOE/ID/12380—6) Investigation of materials for inert electrodes in aluminum electrodeposition cells. Quarterly report, January-March 1984.** (Massachusetts Inst. of Tech., Cambridge (USA)). Jul 1984. Contract FG07-83ID12380. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015036.

Three compositions in the $NiO-Fe_2O_3$ system have been tested in the laser-heated floating zone apparatus. Acquired literature has been used to generate the $NiO-Fe_2O_3$ phase diagram and begin a list of possible dopant additions to this system. Construction of the bench scale Hall cell has been completed. The reference electrode has been further developed. The TiB_2 synthesis program has concentrated on issues related to the volatilization of liquid reactants and on procedures necessary to do experiments safely.

38074 **(KFK—3655) Electrochemical investigations on cesium oxide and alkalimetal hydroxides concerning an hybrid process for hydrogen production.** Haas, K.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). Feb 1984. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84751910.

Electrochemical measurements were made to characterize the molten salt electrolysis of cesium oxide and cesium hydroxide in connection with a three-step-cycle for hydrogen production. The

measured decomposition potential (0,87 V) and the specific electrical conductivity (0,3 $Ohm^{-1}cm^{-1}$) of cesium oxide melts (T=720 K) are leading to the conclusion that the overall electric efficiency of the proposed hydrogen production cycle is favourable compared to that of the direct electrolysis of water. However, especially because of the great corrosion problems of cesium oxide melts this three-step-cycle is not suitable for technical purposes. The molten salt electrolysis of cesium hydroxide with a measured decomposition potential of 2-2,3 V (T=620-770 K) is also incommensurate to the conventional electrolysis of water. Measurements of the specific electrical conductivity of solid and liquid sodium-, rubidium- and cesium hydroxide lead us to the detection of a proton conduction process for rubidium- and cesium hydroxide. This proton conduction process can be explained regarding the cristallographic phase transition of the solid alkali hydroxides, which yields the so-called "rotator-phases" and is confirmed for solid cesium hydroxide by ^{1}H-NMR measurements.

38075 **Surface field limitation in diffuse anodic discharges.** Cheng, W.K.; Dvore, D.; Martinez-Sanchez, M. (Massachusetts Inst. of Technology, Cambridge, MA). *Journal of Energy;* **7**: No. 6, 518-522(Nov 1983).

The discharge structure at the vicinity of an anode and the associated electron induced corrosion rate were studied. As the current density increases, a new active ionization region develops immediately next to the wall as a result of field ionization. The near-wall field was found to be essentially independent of current density, and is of the order of 10^5V/m for combustion gas at 1 atm. The associated corrosion rate is less than 1 μg/C.

4005 Photochemistry

REFER ALSO TO CITATION(S) 40050037443, 37452, 38063, 38065, 38087, 38102, 38130

38076 **Photoprocesses in photosystem I model systems.** Hunt, J.E.; Katz, J.J.; Svirmickas, A.; Hindman, J.C. (Argonne National Lab., IL). *Journal of the American Chemical Society;* **106**: No. 8, 2242-2250(18 Apr 1984). Contract W-31-109-ENG-38.

Photoprocesses in covalently linked bis(pyrochlorophyllide a) ethylene glycol diester molecules have been investigated by laser absorption and fluorescence techniques. Solvent interactions significantly alter the photochemical properties that resemble those of the special pair chlorophyll (P700) of photosystem I of green plants. Photoexcitation of the model system results in the formation of an S_1 state. This excited state returns to the ground state primarily by fluorescence and internal conversion. Under appropriate excitation conditions stimulated (laser) emission is observed. Long (30 ns) excitation pulses produce significant triplet populations. The configuration and possible reactions involving this triplet are discussed. In contrast, the folded pairs in methylene chloride/ethanol solution exhibit an unusually short fluorescence lifetime and a correspondingly low quantum yield. Some of the anomalous behavior of the folded pairs photoexcited in methylene chloride are shown to result from differences in ground-state structure and composition. Rapid internal conversion processes prevent the build-up of a significant excited-state population in this solvent system. The internal conversion process responsible for the lifetime shortening involves the formation of charge-transfer states. 53 references, 9 figures, 3 tables.

38077 **Laser flash photolysis study of paraquat reduction by photogenerated aromatic ketyl radicals and carbonyl triplets.** Baral-Tosh, S.; Chattopadhyay, S.K.; Das, P.K. (Univ. of Notre Dame, Indiana). *Journal of Physical Chemistry;* **88**: No. 7, 1404-1408(29 Mar 1984).

Results of a kinetic study based on 337.1-nm laser flash photolysis are presented for electron-transfer reactions with paraquat (PQ^{2+}) as the oxidant for the triplets of a number of substituted benzophenones and acetophenones and the corresponding ketyl radicals. The ketyl radicals were generated from the ketone triplets by laser flash photolysis in the presence of excess of p-methoxyphenol. The electron-transfer rate constants (2×10^8-8×10^9 M^{-1} s^{-1}) as well as the fractions (0.5-1.0) of the triplet quenching events that result in net reduction of PQ^{2+} correlate well with the electron-releasing nature of the substituents in the ketones. Quantitative data concerning the transient absorption spectra of substituted benzophenone triplets and diarylhydroxymenthyl radicals are also reported. 5 figures, 1 table.

38078 **Determining the number of stochastic degrees of freedom in polyatomic molecules.** Stine, J.R.; Noid, D.W. (Los Alamos National Lab., NM). *Chemical Physics Letters;* **100**: No. 3, 282-286(9 Sep 1983).

Construction of dimensionality plots have proved useful for determining the number of integrals of the motion in dynamical systems with two and three degrees of freedom. The slow convergence in the method is caused by the trajectory not accessing phase space uniformly. Here an information dimension is shown to have better convergence properties. 15 references, 3 figures.

38079 **Reaction of fluorine and chlorine atoms with formaldehyde and deutero-formaldehyde.** Nogar, N.S.; Fasano, D.M. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 232-238(1983).

The reactions were studied using multiple photon dissociation to produce F and Cl atoms. SF_6 and CCl_3F were the atom precursors. Rate of the reaction at 295 K and 0 - 400 mtorr was monitored by ir chemiluminescence. A point of interest is the variation of a measured rate constant with photolysis frequency. 25 references, 5 figures, 1 table.

38080 **Photochemistry of mixed-metal bimetallic complexes containing pentacyanoferrate(II) or pentaammineruthenium(II) metal centers. Evidence for some intramolecular energy-transfer reactions.** Moore, K.J.; Lee, L.; Figard, J.E.; Gelroth, J.A.; Stinson, A.J.; Wohlers, H.D.; Petersen, J.D. (Clemson Univ., SC). *Journal of the American Chemical Society;* **105**: No. 8, 2274-2279(1983). Contract AS09-80ER10671.

The series of complexes $B_5MLM'B'_5$, where B_5M = $(NH_3)_5Ru$/sup II/ or $(CN)_5Fe$/sup II/, L = 4-cyanopyridine (4-CNpy), pyrazine (pz), or 4,4'-bipyridine (4,4'-bpy), and $M'B'_5$ = Rh/sup III/$(NH_3)_5$ or Co/sup III/$(CN)_5$, display highly absorbing metal-to-ligand charge-transfer (MLCT) bands in the visible spectral region that can be assigned as predominantly M(d/sub π/*) in character. MLCT irradiation of these complexes generally leads to cleavage of either the M-L or L-M' bonds. Cleavage of the L-M' bond, a reaction characteristic of an excited state localized on M' (not the metal center initially involved in photon adsorption), is a result of intramolecular, energy-transfer processes. This phenomenon is observed only for the 4-CNpy- and 4,4'-bpy-bridged Ru(II)/Rh(III) bimetallic complexes. The pz-bridged Ru(II)/Rh(III) bimetallic complex shows little photoreactivity at either metal center. All of the Fe(II) bimetallic complexes show Fe(II)-L bond breaking as the sole photochemical process with no evidence of any intramolecular energy transfer. The quantum yields for reactions driven by intramolecular energy transfer are small (10^{-4} < PHI less than or equal to 10^{-2}), but photochemical reactions normally requiring untraviolet incident irradiation can be driven by visible light by using these highly absorbing, antenna fragments as internal sensitizers. 49 references, 2 figures, 3 tables.

38081 **Synthesis, characterization and photochemistry of some monometallic and bimetallic 2,2'-bipyrimidine complexes of chromium and tungsten carbonyls.** Moore, K.J.; Petersen, J.D. (Clemson Univ., SC). *Polyhedron;* **2**: No. 4, 279-284(1983).

Synthesis, electronic absorption spectra, ^{13}C NMR and photochemistry are reported for the complexes $M(CO)_4$bpym (M = Cr or W) and $[W(CO)_4]_2$bpym. The electronic absorption spectra indicate, for these complexes, that the lowest lying metal-to-ligand (L) charge transfer (MLCT) excited state is lower in energy than the ligand field (LF) excited states. The ^{13}C NMR spectra showed that the chemical shifts of C(5) and C(6) for the M-bpym complexes move downfield with respect to that of the free ligand, bpym, while C(4) moves upfield upon complexation. Small, wavelength-dependent quantum yields for loss of CO were obtained upon irradiation. These quantum yields were an order of magnitude larger for the Cr-bpym complex than for the W complexes (PHI = 2.4 x

10^{-2} mols/ein for Cr-bpym, 2.5 x 10^{-3} mols/ein for W-bpym and 1.1 x 10^{-3} mols/ein for W-bpym-W, λ/sub irr/ = 366 nm).

38082 Photochemistry of 9,10-anthraquinone-2-sulfonate in solution. 1. Intermediates and mechanism. Loeff, I.; Treinin, A.; Linschitz, H. (Hebrew Univ., Jerusalem, Israel). *Journal of Physical Chemistry;* **87**: 2536-2544(1983). Contract AC02-76ER03117.

The photochemistry of aqueous 9,10-anthraquinone-s-sulfonate (AQS) was investigated by using four different approaches: (1) laser photolysis of AQS in water as a function of concentration and pH; (2) laser photolysis of AQS in CH_3CN and CH_3CN/H_2O mixtures, combined with emission spectroscopy; (3) steady-state photolytic study of the effect of AQS concentration and pH on the yield of photohydroxylation in water; (4) quenching of intermediates and inhibition of photohydroxylation by inorganic anions. The authors results lead to identification of triplet AQS (tau ~ 100 ns in water) and two other intermediates (B and C) which are formed by two parallel reactions of triplet AQS with H_2O. The nature of these intermediates is still uncertain, but evidence is presented to rule out H abstraction or net electron transfer (even in the case of OH^-) leading to formation of free OH radicals. The possibility that B and C are two different water adducts is discussed. The role of preferential solvation of AQS in CH_3CN/H_2O mixtures in determining its photochemistry is also examined. Species C(λ/sub max/ ~ 600 nm) is the only transient observed which appears to react with ground-state AQS, and this reaction is considered to be responsible for photohydroxylation. Our results provide direct evidence for the validity of the $^3AQS/H_2O$ mechanism proposed by Clark and Stonehill (CS), in which the primary step is reaction of ^3AQS with water (and not with ground-state AQS) to produce the hydroxylating agent. However, this mechanism is modified for pH ≧ 11 by proposing another hydroxylating agent which may be AQS-OH exciplex (or radical pair) produced by charge-transfer (CT) quenching of ^3AQS by OH^-. Evidence is presented to establish the charge-transfer nature of quenching of triplet AQS by various anions including OH^-.

38083 Quantum yield determinations for sub-nanosecond-lived excited states and photoproducts. Applications to inorganic complexes and photosynthetic models. Bergkamp, M.A.; Chang, C.K.; Netzel, T.L. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **87**: No. 22, 4441-4446(1983). Contract AC02-76CH00016.

This paper presents a procedure for determining the quantum yields of nonluminescent excited states and photoproducts with subnanosecond lifetimes. The authors describe both a procedure for calibrating the intensity of the photoexcitation pulse (einstein cm^{-2} $pulse^{-1}$) and a numerical calculation of percent excitation for an optically dense sample. Particular attention is paid to the case for which a large fraction of starting material is transformed into photoproduct, a common occurrence in picosecond absorption spectroscopy. As motivating applications, determined are the quantum yields of (1) the lowest energy ligand-field excited state of $Fe(phen)_3^{2+}$ (phen = 1,10-phenanthroline) and (2) the 200-ps-lived electron-transfer (ET) photoproduct (Mg^+-H_2^-) in a diporphyrin model of photosystem II (PSII) to be 1.00 +/- 0.05 and 0.9 +/- 0.1, respectively. In both cases the observed photoproducts are formed from the decay of ultrashort-lived, initial excited states (tau < ps). 29 references, 4 figures.

38084 Spectroscopic studies of molecular interactions of oxygen-16 and oxygen-18 in the high-density epsilon-phase. Swanson, B.I.; Agnew, S.F.; Jones, L.H.; Mills, R.L.; Schiferl, D. (Los Alamos National Lab., NM). *Journal of Physical Chemistry;* **87**: No. 14, 2463-2465(1983).

Infrared and Raman spectra were obtained for solid $^{16}O_2$ and $^{18}O_2$ as a function of pressure, using diamond-anvil cells. When both isotopes are compressed into the epsilon-phase near 9.9 GPa, a strong infrared band appears in the O-O stretch region, 48 cm^{-1} lower than the Raman-active O-O stretch. As pressure is increased, the infrared absorption shifts to lower frequency, eventually splitting into two bands at 16.0 GPa. Two combination modes, which also shift to lower frequency with increasing pressure, are observed in the 3000-cm^{-1} region of the IR spectra. The epsilon-phase also exhibits a second Raman mode around 130 cm^{-1}, which shifts to higher frequency with pressure. The results indicate that the O-O bond weakens at the expense of forming O_2-O_2 intermolecular interactions in the epsilon-phase. The spectroscopic results show that the structure of the epsilon phase is centric with, most likely, four molecules per primitive cell. 16 figures, 2 references, 1 table.

38085 Resonance Raman spectra of picosecond transient: application to bacteriorhodopsin. El-Sayed, M.A.; Hsieh, C.L.; Nicol, M. (Technische Universitaet Munchen, Garching, West Germany). pp 302-307 of Picosecond phenomena III. Eisenthal, K.; Hochstrasser, R.; Kaiser, W.; Laubereau, A. (eds.). Berlin, Germany, F.R.; Springer-Verlag (1982).

This method utilizes a mode-locked cavity dumped synchronously pumped dye system producing a million pulses/s. The scattering radiation is collected with a spectrometer fitted with vidicon detection. A unique sample flow system produces a sample residence time of 0.10 μs, which is 10 times shorter than the time between pulses. Examination of the resonance Raman spectra of bacteriorhodopsin transients in the 30 - 50 picosecond time scale suggests that retinal isomerization takes place during this time span. Some evidence indicates that a change in the cyanido stretching frequency occurs upon transformation into the picosecond transients.

38086 Time resolved transmission and reflectivity of pulsed ruby laser irradiated silicon. Lowndes, D.H.; Jellison, G.E. Jr.; Wood, R.F. (Oak Ridge National Lab., TN). pp 73-78 of Laser and electron-beam interactions with solids. Appleton, B.R.; Celler, G.K. (eds.). New York, NY; Elsevier Science Publishing Company, Inc. (1982). Contract W-7405-ENG-26.

The time resolved optical transmission, T (at λ = 1152 nm), and reflectivity, R (at 633 nm and 1152 nm), have been measured for n-type single crystalline silicon (c-Si) during and immediately after pulsed ruby laser irradiation (λ = 693 nm, FWHM pulse duration 14 nsec), for a range of pulsed laser energy densities, E/sub l/. The T is found to go to zero, and to remain at zero, for a period of time that increases with increasing E/sub l/, in apparent disagreement with earlier measurements elsewhere that used semi-insulating Si and a different pulsed laser wavelength. Measured reflectivities during the high R phase agree within experimental error with reflectivities calculated from the optical constants of molten Si. Quantitative agreement is also found between both our T and R measurements and detailed time- and E/sub l/-dependent results of thermal melting model calculations. 13 references, 3 figures.

4006 Radiation Chemistry

38087 (DOE/ER/00038—2574) Radiation Laboratory, University of Notre Dame. Quarterly report, January 1-March 31, 1984. (Notre Dame Univ., IN (USA). Radiation Lab.). 15 Jun 1984. Contract AC02-76ER00038. 45p. (NDRL—2574). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014938.

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Seventy-one abstracts are presented of research in photochemistry and radiation chemistry of various compounds. (DLC)

38088 (INIS-SU—197, pp 84-85) Impulse radiolysis of solid sodium and potassium nitrates. Safonov, Yu.N.; Dolganov, V.S. (Kemerovskij Gosudarstvennyj Univ. (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780108.

In Radiation damage physics and radiation technology.

The method of pulsed optical spectroscopy has been used to investigate short-lived products of radiolysis (0.25-0.3 MeV electron radiation) of solid nitrates of alkali metals in the 80-440 K temperature range. Analysis of absorption spectra of irradiated solid salts permitted to reveal and identify some short-lived products of radiolysis (NO_3 instab., NO_3 stab., NO_3^{2-}; e^- stab.). Kinetics of relaxation is studied in a wide temperature range and kinetic parameters of short-lived products are determined. It is shown that mean life time essentially decreases with radiation temperature increase. Activation energies of thermal destruction of pulsed radiolysis products are determined. Mechanism of formation and destruction of short-

lived products is discussed in detail based on the obtained data, and an attempt of quantitative estimation of their contribution in the formation of final products is made.

38089 **(ITEF—115(1982)) Formation mechanism and nature of radiolytic hydrogen peroxide precursors in water.** Tret'yakova, N.I.; Byakov, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702559.

Numerous experimental data available in literature on inhibition of radiolytic hydrogen peroxide formation yields in water by dissolved substances are compared with the equations resulting from a diffusion-recombination model of water radiolysis: Gsub(Hsub(2)Osub(2))=Gsub(Hsub(2)Osub(2))sup(0)-qCsub(A)sup(1/3) and 1/GsWb,-(Hsub(2)Osub(2))=A+BxCsub(A), where Csub(A) is the concentration of substances dissolved in water. The coefficients involved in the equations are determined by the least square method and compared with theoretical values. One succeeds in attaining a satisfactory agreement of theory with experiment under the assumption that hydrogen peroxide precursors are OH-radicals. Their initial concentration is obtained to be equal 0.24 M, the yield of radicals that escaped from the intratrack recombination = 0.49xGsub(-Hsub(2)O, where Gsub(-Hsub(2)O - total water decomposition yield.

38090 **(NIIAR—14(529)) Study of berkelium (4) self-reduction in perchloric and nitric acid solutions.** Erin, E.A.; Vityutnev, V.M.; Kopytov, V.V.; Vasil'ev, V.Ya. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701537.

By using the spectrophotometric method the kinetics and mechanism of berkelium (4) self-reduction in perchloric and nitric acid solutions have been investigated. It has been found that berkelium (4) self-reduction occurs only at the expense of Bk (4) interaction with the solution radiolysis products. The rate constants for Bk (4) self-reduction and the radiation-chemical yields for Bk (3) in the above media have been estimated.

38091 **Geometry of the CH_2OR radical in X-irradiated crystals of methyl β-D-galactopyranoside: an ESR/ENDOR study.** Bernhard, W.A.; Horning, T.L.; Mercer, K.R. (Univ. of Rochester School of Medicine and Dentistry, NY). *Journal of Physical Chemistry;* **88**: No. 7, 1317-1320(29 Mar 1984). Contract AC02-76EV03490.

A CH_2OR radical is trapped in single crystals of methyl β-D-galactopyranoside X-irradiated at $\sim$ 12 K. ENDOR measurements at $\sim$ 6 K were used to determine the two α-hydrogen and one γ-hydrogen hyperfine coupling tensors. The α-hydrogen tensors, determined to a high degree of accuracy, were used to calculate the geometry about the free-radical center. The CH_2OR radical is slightly bent with theta = 2.3 +/- 1.0 where theta is the angle between the nodal plane of the lone electron orbital and the three σ-bonds (O-C, H-C, H'-C). The three angles H-C-H', O-C-H, and O-C-H,' are 125.7 +/- 0.7°, 116.9 +/- 0.8°, and 117.2 +/- 0.8°, respectively. With a two-center dipole approximation the /sub α/H-C bond lengths are found to be ca. 1.00 Angstrom, that is, about 0.10 Angstrom shorter than the H-C bonds in the nonradical. The unpaired electron densities are rho/sub c/ $\geqq$ 0.83 and $rho_o \leqq$ 0.17. 3 figures, 2 tables.

38092 **Radical anion structure of β-halogen-substituted acetamides in X-ray-irradiated single crystals: an INDO and EPR study.** Samskog, P.O.; Kispert, L.D. (Univ. of Alabama, Tuscaloosa). *Journal of Physical Chemistry;* **88**: No. 7, 1385-1388(29 Mar 1984).

The anion radicals of bromodifluoroacetamide and chlorodifluoroacetamide are investigated by using the INDO method and EPR spectroscopy. INDO calculations for the anions give a spin density distribution in agreement with that suggested from experiment. Results of the analyses show that the unpaired electron occupies the σ^* orbital composed of the rho orbitals, along the C/sub β/-X bond, on the carbon and the unique halogen atoms. The results are compared to the radical anion in trifluoroacetamide. The electronic structure of $SCF_2CONH_2^-$ radical anions is a π-radical anion when X = F and a σ^*-radical anion when X = Cl and Br. 2 figures, 4 tables.

38093 **Free radical decay in adamantane.** Tegowski, A.T.; Pratt, D.W. (Univ. of Pittsburgh, PA). *Journal of the American Chemical Society;* **106**: No. 1, 64-67(11 Jan 1984). Contract AC02-76ER03435.

Kinetic electron paramagnetic resonance (EPR) techniques have been used to characterize the decay behavior of the "stable" free radical 2-cyclohexanonyl in the plastic crystal phase f an adamantane matrix over the temperature range 257-313 K. Typical plots of the EPR signal intensity as a function of time are biexponential in nature, suggesting the existence of at least two channels for free radical decay. The activation parameters for both processes have been measured in both protonated and deuterated samples. A comparison of these results with those in other systems suggests that the host does, as expected, considerably reduce the pre-exponential factors for decay of the radical by bimolecular processes but has relatively little influence on the corresponding activation energies. 3 figures.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 40070037330, 37331, 37369, 37371, 37682, 37683, 38536, 38552

38094 **(AECL—7817) Assessment of the thermodynamic behavior of neptunium in water and model groundwaters from 25 to 150°C.** Lemire, R.J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Mar 1984. 62p. Scientific Document Dist. Office, AECL, Chalk River, Ontario, Canada. Order Number TI84901537.

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Standard molal Gibbs energy of formation and entropy data for simple neptunium solids and aqueous neptunium complexes with OH^-, Cl^-, F^-, CO_3^{2-}, PO_4^{3-}, SO_4^{2-} and Na^+ have been critically reviewed. Selected values are used with estimated heat capacity values to derive self-consistent analytical expressions for the temperature dependence of the standard molal Gibbs energies of formation of the species from 25 to 150°C. The Gibbs energies have been used to evaluate the effect of different concentrations of ligands on the solubility of neptunium solids as a function of temperature. Potential-pH diagrams are given for neptunium in pure water and in two model groundwaters. Important deficiencies in the available thermodynamic data for neptunium species are discussed. 90 references, 12 figures, 6 tables.

38095 (INIS-mf—7782, pp 109-115) **Some special problems in preparation of radioactive standard solutions.** Schonfeld, E. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Method is described of fabrication of radioactive standard solutions and their preparation for measurement of activity by means of 4π - counters. Main stages of fabrication of standard solutions have been listed and described, in particular; investigation on purity of padionuclides being intended as a row material; control measurement of activity; fabrication of standard solutions and preparation containers for their packing; measuring of activity of standard solutions which had been prepared; packing of solutions un ampules; official registration of sertificate for the standard. A method has been stated also in the paper of preparation of samples for measurement of their activity.

38096 (INIS-mf—8961, pp 224-231) **Investigations on development of methodology for determination of chlorides content in technological solutions in reprocessing of spent fuels from nuclear power plants.** Novak, D.; Tsegledi, B.; Chevari, M.; Roder, M.; Kulesh, I.; Sabo, Eh.; Akopov, G.A.; Abdulakhatov, M.A. 1981. (In Russian). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780260. (CONF-8104231—Vol.1).

From 5. CMEA symposium on investigations in the field of reprocessing of irradiated fuel and radioactive wastes disposal; Marianske Lazne, Czechoslovakia (7 Apr 1981).

Development is described in the paper of a method for determination of chloride concentration in technological solutions of reprocessing of the spent fuels from a nuclear power plant by means of application of the chlorine-selective electrodes. Methodology has been developed which permits measurement of concentration of the chlorine ions in the limits from 100 ml/l and more and having accuracy of 10% relative. Results also have been stated of the investigation on the radiation resistivity of the electrodes as well as of the influence of different factors on the changes in measurements of concentrations of chloride ions by means of the chlorine-selective electrode. 4 references, 3 figures, 3 tables.

38097 (INIS-SU—198, pp 97) **^{137}Eu new isotope. Decay of ^{137}Sm.** Alkhazov, G.D.; Ganbaatar, N.; Gromov, K.Ya. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38098 **(JINR—12-82-851) Preparation of ^{172}Lu generators.** Lebedev, N.A.; Kherrmann, Eh.; Ehkhn, L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701514.

A method for preparation of ^{172}Lu generator has been developed and dynamic stability has also been examined. Mother isotope ^{172}Hf has been produced from a fluoronitric aciqueous solution of tantalum, irradiated with 660 MeV protons. Isolation of Hf from the solution ivolved: coprecipitation with CaF_2 and extraction with benzene solution of thenoylthreefluoroacetone, adsorption on reverse phase chromotographic column filled with silicagel containing toluene solution of di(2-ethylhexyl)phosphoric acid. Total radiochemical yields of ^{172}Hf has been found to be 45%. ^{172}Lu from the column could be eluted with 6M HCl. The total volume of eluent necessary for 90% eluation of Lu increases from 5-6 to 70 free volumes during 1-1.5 years. The losses of ^{172}Hf activity for one elution cycle does not exceed 0.1%.

38099 **(JINR—R-6-82-859) Thermochromatographic behavior of iridium and platinum oxygen-containing compounds in trace amounts.** Domanov, V.P.; Ajkhler, B.; Zvara, I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701513.

The compounds of carrier-free radioactive Ir and Pt formed in air stream at 725+-75 deg C were separated on a quartz thermochromatographic column. The effect of the technique of initial radioplatinoid sample preparation and the experimental conditions such as carrier gas humidity, on the yield of Ir and Pt volatile compound was studied. Both elements have formed two adsorption zones, under certain conditions the centers of the Ir zones being at 265+-20 deg C and 175+-20 deg C, and those of Pt - at 280+-20 deg C and 55+-15 deg C. The composition of the compounds involved is discussed on the basis of the available data, new experimental results and estimates of their thermochemical properties. The oxides MeO_3 are supposed to be adsorbed at higher temperatures while the compounds deposited in low temperature zones seem to be acids.

38100 (LA—9933-C-Vol.2, pp 886-905) **LAMPF II Nuclear Chemistry Working Group report from the nuclei-far-from-stability section.** Vieira, D.J.; Talbert, W.L. Jr. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

During the period of July 18-21, as part of the Third LAMPF II Workshop, about 30 nuclear chemists and physicists from over 10 laboratories and universities convened to discuss the near- and far-term research possibilities in the area of nuclei far from stability. Invited speakers presented new experimental and theoretical results and outlined potential areas of research at LAMPF II during the first two afternoons of the Workshop. Informal meetings were held to discuss the specific topics of the planned TOFI spectrometer mass measurements and the merits of a He-jet-coupled mass separator at LAMPF. The production of nuclei far from stability via proton reactions at projected LAMPF II energies was explored to define research possibilities at a proposed thin target facility (TTF). Future TTF experiments and configurations were discussed.

38101 **Recoil fluorine-18 chemistry. 14. High-pressure investigation of C_2F_6.** Knickelbein, M.B.; Xue, Z.; Root, J.W. (Univ. of California, Davis). *Journal of Physical Chemistry;* **88**: No. 10, 2017-2024(10 May 1984). Contract AM03-76SF00034.

With gas-phase C_2F^6 nuclear recoil ^{18}F undergoes F-for-F, F-for-CF_3, and F-for-2F, hot atom elementary reactions with respective primary yields of 13.8 +/- 0.2%, 0.68 +/- 0.03%, and 1.90 +/- 0.05%. Under collisionless conditions, 91 +/- 2%, 57 +/- 2%, and 35 +/- 3% of the nascent products from these relaxations decompose. At pressures below 1 ktorr, 22 +/- 2% of the F-for-F product, $CF_3CF_2{}^{18}F$ undergoes complete atomization through sequential C-C and C-F bond dissociations. Above 50 ktorr, caging reactions enhance the yields of most of the observed products. 49 references, 8 figures, 6 tables.

38102 **Orientational ordering and site-selective photochemistry of UF_6 isolated in argon matrices.** Jones, L.H.; Swanson, B.I.; Ekberg, S.A. (Los Alamos National Lab., NM). *Journal of Physical Chemistry;* **88**: No. 7, 1285-1286(29 Mar 1984).

High-resolution studies of the ν_3 mode of UF_6 in argon matrices show two dominant sites with a high degree (80%) of orientational ordering. Upon photolysis UF_5 is formed but recombines in part to form UF_6 on metastable sites. One site is considerably more amenable to photolysis than the other. On high-temperature annealing (40 K) all the UF_5 is converted back to UF_6 and the original dominant sites are re-formed to a considerable extent. Through all this photoexcitation, dissociation, recomvination, and annealing the original ordering is preserved. 2 figures.

38103 **Pulse radiolysis study of the oxidation of methyl substituted ascorbates.** Cabelli, D.E.; Bielski, B.H.J. (Brookhaven National Lab., Upton, NY (USA)); Seib, P.A. (Kansas State Univ., Manhattan (USA)). *Radiation Physics and Chemistry;* **23**: No. 4, 419-429(1984).

The oxidations of 1-O-methyl-L-ascorbic acid, 2-O-methyl-L-ascorbic acid, 3-O-methyl-L-ascorbic acid, and 2,3-di-O-methyl-L-ascorbic acid by OH radicals and Br_2^- were studied by pulse radiolysis. All three mono-substituted ascorbates react with Br_2^- to form the corresponding ascorbate free radicals: 1-O-MeA, 2-O-MeA and 3-O-MeA. In reactions with OH radicals these compounds first form adducts, some of which subsequently yield the aforementioned free radicals while others yield unidentified transients and/or products. Proposed reaction mechanisms for these systems are supported by HPLC studies.

38104 **Orthorhombic uranium(IV) molybdenum(VI) oxide, UMo_2O_8.** Cremers, T.L.; Eller, P.G.; Penneman, R.A.; Herrick, C.C. (Los Alamos National Lab., NM). *Acta Crystallographica, Section C: Crystal Structure Communications;* 1163-1166(1983).

M/sub r/ = 557.8, orthorhombic, Pban, a = 20.076 (4), b = 7.323 (1), c = 4.1164 (6) angstrom, V = 605.2 angstrom^3, Z = 4, D/sub m/ = 6.08 (6), D/sub x/ = 6.12 Mg m^{-3} Mo Kα, λ = 0.70930 angstrom, μ = 367 cm^{-1}, F(000) = 960, T = 298K, R = 0.049 for 1347 reflections. The structure consists of layers of oxide-bridged uranium and molybdenum atoms connected by infinite interlayer U-O-U and Mo-O-Mo chains. The uranium atoms have pentagonal bipyramidal coordination [U-O equatorial = 2.202 (6)-2.394 (8) angstrom, U-O axial = 2.0584 (3) angstrom]; the molybdenum atoms are in a highly distorted octahedral [Mo-O = 1.684 (7)-2.432 (7) angstrom] arrangement. The presence of oxide ions not connected to molybdenum suggests that this structure is better formulated as a double oxide-molybdate than as a true molybdate. 20 references, 1 figure, 2 table.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

38105 **Thermal decomposition of hydrogen cyanide behind incident shock waves.** Szekely, A.; Hanson, R.K.; Bowman, C.T. (Stanford Univ., CA). *Journal of Physical Chemistry;* 88: No. 4, 666-668(16 Feb 1984). Contract AM03-76SF00326.

The thermal decomposition of hydrogen cyanide was studied over the temperature range 2700-3600 K by using a shock tube technique. HCN-Ar mixtures (12-200 ppmv HCN) were heated by incident shock waves and CN absorption at 388 nm ($B^2\Sigma^+$, μ = 0 reversible $X^2\Sigma^+$, μ = 0 electronic transition) was used to follow the progress of the decomposition. The low-pressure rate coefficient for the reaction HCN + Ar → H + CN + Ar (1) was closely fit by the Arrhenius expression k_1 = 10/sup 16.0+/-0.15/ exp[-(54650 +/- 1110)/T] cm^3/mol s. The present results are discussed and compared with previously published determinations.

38106 **An overview of combustion noise.** Putnam, A.; Faulkner, L. (Battelle Columbus Laboratories, Columbus, OH). *Journal of Energy;* 7: No. 6, 458-469(Nov 1983).

Combustion noise was discussed as early as 1802 in a technical note on singing flames. Occasional papers followed this early work up to about 1950, when jet propulsion spurred interest. Since then there has been a continual broadening of the areas of interest: Now the phenomena related to combustion noise are considered in a host of specific uses of combustion. This review is based on the authors' observations of nonpropulsive combustion in the residential, commercial, and industrial fields, although it is realized that there are many parallels to specific propulsive applications. Three specific areas of combustion noise are discussed in some detail, namely, combustion roar, combustion-driven oscillations, and pulse combustion. Combustion roar, in the absence of acoustic distortion effects, is characterized by a smooth noise spectrum related to the reacting chemistry of the flame and the turbulence level of the combustion region. Combustion-driven oscillations are characterized by a discrete frequency and a feedback cycle to maintain the oscillation. Pulse combustion is the positive application of combustiondriven oscillations. In addition, some other combustion noise phenomena are discussed, such as the interaction with vortex shedding and the combustion amplification of flow phenomena.

42 ENGINEERING

REFER ALSO TO CITATION(S) 42000038392

4201 General Engineering

REFER ALSO TO CITATION(S) 42010039088

38107 **(EPRI-NP—3516) Using ABAQUS: an introductory course.** Hibbitt, H.D. (Hibbitt, Karlsson and Sorensen, Providence, RI (USA)). Jun 1984. 102p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920496.

This workbook is written to accompany a set of videotape lectures that have been produced to introduce a new user to the ABAQUS program. ABAQUS is a general purpose, production oriented, finite element code. It is very simple to use, and has capabilities for a wide range of nonlinear applications. The lectures describe the basic capabilities of the program, explain its documentation and input formats, and illustrate its use by describing the definition and output of two small nonlinear cases: a large displacement, inelastic, dynamic impact example, and a thermal shock example that includes heat transfer analysis and elastic-plastic-creep mechanical behavior. The workbook is intended as a guide to the videotapes. It contains documentation and output plots for the two cases described in the lectures, and a set of exercises that are intended to allow the user to gain experience with running the program, and to broaden his knowledge of practical aspects of finite element analysis, especially in nonlinear structural applications.

38108 **(NUREG/CR—3599) Sources of uncertainty in the calculation of loads on supports of piping systems.** Rodabaugh, E.C. (Oak Ridge National Lab., TN (USA)). Jun 1984. Contract AC05-84OR21400. 71p. (ORNL/Sub—82-22252/2). NTIS, PC A07/MF A01 - GPO; GPO Dep. Order Number DE84013437.

Loads on piping systems are obtained from an analysis of the piping system. The piping system analysis involves uncertainties from various sources. These sources of uncertainties are discussed and ranges of uncertainties are illustrated by simple examples. The sources of uncertainties are summarized and assigned a judgmental ranking of the typical relative significance of the uncertainty.

38109 **(SAND—83-0025) Comparison of free component mode synthesis techniques using MSC/NASTRAN.** Martinez, D.R.; Gregory, D.L. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014451.

MSC/NASTRAN was used to compare three techniques of component mode synthesis (CMS) using free modes. A free-free beam model was analyzed by the three methods and compared to the finite element results for the entire beam. The three CMS techniques use different combinations of assumed displacement vectors. Two of the techniques are available as standard options within MSC/NASTRAN. The third uses residual terms and is ideally suited to using results from an experimental data base to describe a portion of the model. For this technique, we studied the effects of including residual terms only in the stiffness matrix or in both the mass and stiffness matrices, as well as neglecting the off-diagonal residual terms. Significant divergence of low-frequency system modes was obtained when using one technique while excellent and identical convergence was obtained using the other two. Results are given for modal frequency convergence, mode shape correlation, and mode shape convergence.

38110 **(SAND—84-0193) MC2969 escapement study.** Orrell, M.G. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014542.

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The average angular velocity of a runaway (verge) escapement was obtained from an approximate closed form solution, a computer simulation, and from experimental data. The closed form solution developed an equation for the average angular velocity of the escape wheel as a function of applied torque, number of escape wheel teeth, average ratio of the escapement lever arms, and the mass moments of inertia of the escape wheel and verge. The computer simulation used the DRAM (Dynamic Response of Articulated Machinery) program to numerically integrate the escapement motion. In the experiment, the beat rate of an escapement was recorded and converted to the average angular velocity of the escape wheel. The closed form and computer simulation solutions gave results within 10% of the experimental results in the actual operating range of the escapement mechanism.

38111 **(UCRL—89356-Rev.1) Interaction of a stream of dielectric spheres in an electric field in a high vacuum.** Hendricks, C.D.; Kim, K. (Lawrence Livermore National Lab., CA (USA); Illinois Univ., Urbana (USA). Dept. of Electrical Engineering). 25 May 1984. Contract W-7405-ENG-48. 14p. (CONF-831070—2-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014714.

From IEEE/IAS glass industry committee meeting; Mexico City, Mexico (3 Oct 1983).

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The interaction of a stream of dielectric spheres in an electric field in a high vacuum is investigated both theoretically and experimentally. This investigation is motivated by an attempt to detect fractional electric charges which might exist in matter, namely, a search for isolated quarks in matter. The theoretical analysis is intended to pinpoint the basic interaction mechanism by which a stream of dielectric spheres becomes destabilized in an electric field. One important result of this analysis is a suggested method by which the destabilizing forces can be eliminated. The experiments performed are intended to study the behavior of a stream of uniform liquid drops in an electric field in a high vacuum. It is seen from these experiments that the deflections of any two drops in the stream with charges differing by one electronic charge is the same except for the effects of some destabilizing forces.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 42020037330, 37331, 37501, 37565, 37939, 38141, 38365, 39048

38112 **(AD/A—088701) Rotordynamic instability problems in high-performance turbomachinery.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Aug 1980. 458p. (NASA-CP—2133; CONF-8005250—). NTIS, PC A20. Order Number TI84900879.

From NASA conference on rotordynamic instability problems in high-performance turbomachinery; College Station, TX, USA (12 May 1980).

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Separate abstracts were prepared for 29 papers in this proceedings. (LEW)

38113 (CERN—83-03, pp 305-329) **Survey of advanced general-purpose software for robot manipulators.** Latombe, J.C. (IMAG, 38 - Grenoble (France)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

Computer-controlled sensor-based robots will more and more common in industry. This paper attempts to survey the main trends of the development of advanced general-purpose software for robot manipulators. It is intended to make clear that robots are not only mechanical devices. They are truly programmable machines, and their programming, which occurs in an imperfectly modelled world,is somewhat different from conventional computer programming.

38114 **(DOE/ET/10393—1587) Outline test plan for test series I.** (NCB (IEA Grimethorpe) Ltd., Grimethorpe, Barnsley, South Yorkshire (UK)). Feb 1981. Contract AI01-76ET10393. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009278.

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The overall technical objectives for the Phase 1 programme of the Grimethorpe Experimental Facility were presented in a draft document "Phase 1 Research Programme: Baseline and Modified Option Cases", produced in May 1979 and discussed at subsequent Technical Committee Meetings. The technical objectives for Test Series 1 presented in this document have developed from those outlined in the May 79 baseline; all the changes from the earlier outline are recorded. The data collection systems expected to be used are also presented. It is planned to carry out experiments to meet the objectives in three sub-series each along a different "good fluidisation" line determined at high, medium and low velocities. The high velocity sub-series has four runs including the original design conditions for Tube Bank 'A'. The medium velocity sub-series has seven runs and involves operating Tube Bank 'A' at what are to be its optimum operating conditions. The low velocity sub-series has six runs including the CURL Link Test operating conditions.

38115 **(LA—10056-MS) Resistance and inductance calculations for helical flux compression generators.** Schnurr, N.M. (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015068.

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Methods have been developed to calculate the resistance and inductance of explosively driven helical flux compression generators. The coil radius, armature radius, and wire diameter of the generator must be constant, but the number of parallel paths in the coil is arbitrary and bifurcation of conductors is allowed. The inductance is calculated as a function of time in the stand-alone computer code HFCGL. The results may be used as input to the Los Alamos Railgun Estimator (LARGE) code. Resistance calculations are performed in the subroutine HFCGR developed for use in the LARGE code.

38116 **(PB—84-192954) Thermal conductivity of glass fiber/epoxy composite support bands for cryogenic dewars, phase 2. Final report Jan-Sep 83.** Hust, J.G. (National Bureau of Standards, Boulder, CO (USA). Inst. for Basic Standards). Mar 1984. 24p. (NBSIR—84-3003). NTIS, PC A02/MF A01.

The thermal conductivities of three specimens of glass fiber/epoxy composites were measured and reported for the temperature range 4 to 300 K. These specimens were fabricated from two cryogenic dewar support bands. An average conductivity curve for the three specimens is presented. The data for the three specimens are within + or - 5% of this average curve. The average curve is compared to a similar curve obtained five years ago in Phase I of this continuing study of composite materials.

38117 **(SAND—84-0316C) Effects of thermal and mechanical loading on PDC bit life.** Glowka, D.A.; Stone, C.M. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 18p. (CONF-8409104—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014987.

From 59. annual Society of Petroleum Engineers of AIME technical conference; Houston, TX, USA (16 Sep 1984).

Portions are illegible in microfiche products; Paper SPE 13257.

The results of numerical analyses conducted to determine the effects of thermal and mechanical loading on the integrity of polycrystalline diamond compact (PDC) cutters during deep hole drilling are presented. Cutter temperature distributions for several drilling environments are combined with appropriate mechanical cutting loads to predict stress distributions for the study of cutter wear mechanisms. A discussion of wear mechanisms acting on the cutting structure is presented. Suggestions are presented, based on these analyses, for the operation of PDC bits to increase bit life in hard, abrasive rock drilling. Microstructural design considerations for the cemented carbide that supports the diamond layer are also discussed.

38118 **(UCRL—15604) Phase I study for a mobile gypsum cement blending and pumping unit.** (Process Design Associates, Inc., Chicago, IL (USA)). 28 Feb 1984. Contract W-7405-ENG-48. 193p. NTIS MF A01; 2; GPO Dep. Order Number DE84012690.

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The extent of the Phase I portion of the design of a gypsum cement blending and pumping system is as follows: perform the required engineering and preliminary layout of the system in order to appraise the possibility of constructing a viable systems with readily available components. This shall cover basic material specifications,

the selection of types and sizes of equipment and the preparation of sufficient drawings to illustrate the general equipment layout.

38119 **Measurement of critical temperature as a function of field.** McInturff, A.D.; Ishibashi, K.; Heard, G.D. (Fermi National Accelerator Lab., Batavia, IL). *Cryogenics;* **24**: No. 4, 214-218(Apr 1984).

The critical temperature has been measured for various magnet conductors as a function of the perpendicular applied magnetic field. The temperature gradient across the sample volume was measured to be less than 25 millikelvins. The superconducting to normal state transition was measured resistively, using sample current densities from 0.01 to 2 A cm^{-2}. The maximum applied magnetic field was 10 T and varied less than 0.5% in the sample volume. The critical transport current range of the samples measured from tens to thousands of amperes in the presence of a 10 T perpendicular magnetic field at 4.2 K.

4203 Lasers

REFER ALSO TO CITATION(S) 42030038227, 38792, 39033, 39039, 39040

38120 **(AD-A—137983/3) Temporal measurement of spectrally resolved output of multiline HF lasers. Technical report.** Bernard, J.M.; Ross, D.H.; Coffer, J.G.; Chodzko, R.A.; Mason, S.B. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). 31 Dec 1983. 23p. (TR—0084(4930-01)-4). NTIS, PC A02/MF A01.

An indium-arsenide detector array installed at the focal plane of a grating spectrometer provides the time history of the intensity of each output line of multiline HF chemical lasers. The construction and calibration of this instrument are discussed, and representative data presented. Line competition measurements are shown for a 200-W supersonic-diffusion-type HF laser; individual line outputs fluctuate more than total multiline output. The spectral effects of forward/reverse-wave competition on an unstable ring resonator operating at 350 W are detailed. Simultaneous singe-line gain measurements on a multiline HF medium are demonstrated. Other applications of this useful instrument are discussed.

38121 **(AD-A—138055/9) Construction of a Nd:YAG laser and observation of the output. Master's thesis.** Chung, K.H. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1983. 64p. NTIS, PC A04/MF A01.

An experimental Neodymium YAG laser system has been constructed using a cylindrical pumping reflector containing three CW tungsten-halide lamps. Maximum laser output of 2.05 watts has been obtained with slope efficiency 0.19 percent at 3300 watts input power. Slope efficiency increased with increasing input power, and output power decreased with increasing resonator length.

38122 **(AD-A—138056/7) Analysis of laser spot quality. Master's thesis.** Pitts, W.D. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1983. 92p. NTIS, PC A05/MF A01.

A four-moment method is presented to analyze the quality of laser beam spots. The first four central moments are calculated on two-dimensional transverse intensity distributions of several laser spots. The four moments represent the center, spread, skewness, and peakness, respectively of the spot. A pure Gaussian and uniform intensity spot were included as controls. A photograph of each laser spot was scanned by a TV camera and digitized. Each spot generated 31K (31744) pixel elments of data. Each pixel was weighted by the intensity at that point. The data were then processed by a computer to get the moments. The first moment was reported as a pair of numbers, representing the coordinates of the center of the spot. The second, third and fourth moments were reported as four, eight and sixteen element tensors, respectively. An eigenvalue problem was formed from the second moment, yielding an angle of general spread from the center. Symmetric distributions, such as the Gaussian and uniform, showed near-zero third moments, as expected. The position of a spot only affected the first moment, as expected. The Gaussian and uniform distributions are ideals against which to compare other laser spots.

38123 **(AD-A—138057/5) Microwave excitation of a CO_2 laser. Master's thesis.** Page, R.C. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1983. 98p. (AFIT/GEP/PH—83D-8). NTIS, PC A05/MF A01.

A flowing carbon dioxide laser was operated at low pressures up to 4 torr. Excitation of the laser was provided using various combinations of direct current (DC), pulsed microwave, and continuous wave (CW) microwave excitation. The microwaves were in the 2.45 GHz band and were coupled into the gas using a slow-wave interdigital transmission line. Laser output of 25 milliwatts (mw) was achieved using a DC discharge only. A combination of a DC discharge and pulsed microwaves doubled the output and resulted in some modulation. Changing the laser gas mixture and pulsed microwave field characteristics allowed some flexibility in the modulation. Lasing was not achieved with excitation from the CW microwaves alone due to the formation of localized discharges. Using pulsed microwaves to sustain the discharge and CW microwaves to pump the laser, a quasi-CW output of 55 mw was achieved.

38124 **(AD-A—138076/5) Study of a tunable CO_2/N_2O medium pressure waveguide laser. Master's thesis.** Bigelow, A.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1983. 94p. NTIS, PC A05/MF A01.

The operational characteristics of a CO_2 waveguide laser, capable of both inter-line and intra-line tuning, were investigated. This system exhibits an overall simplicity in design and construction. In addition, only inexpensive and readily available materials are required. The range of gas pressure in the discharge extended from 25 Torr to 162 Torr while using a 20/10/70 gas mixture of $CO_2.N_2/He$. The P(20) line, which was scanned using piezoelectric transducer, had a tunable linewidth of 215 Mhz. This linewidth was limited by the 220 MHz free spectral range of the cavity. In the multi-line configuration, the maximum output was 7.5 W. A grating was used to achieve inter-line tuning; a total of 50 different lines of the P and R branches of the 10.4 m and 9.4 m lased. A maximum output power of 2.2W, P(20), was achieved durng single line operation. A 9.9/9.8/80.3 gas multi-line configuration a maximum output of 825 mW was achieved.

38125 **(AD-A—138198/7) Diode pumped fiber laser. Interim technical report Apr 82-May 83.** Digonnet, M.J.F.; Shaw, H.J. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Jul 1983. 215p. (GL—3582). NTIS, PC A10/MF A01.

The objective of this program was the study and exploratory development of a miniature solid state laser source as a potential signal source in a variety of fiber optic sensors and systems. The specific source to be studied was composed of a single-crystal Neodymium-YAG optical fiber end-pumped with a single semiconductor laser diode.

38126 **(AD-A—138324/9) Spectroscopic investigations of materials for tunable infrared lasers. Annual progress report No. 2, 1 Mar 83-28 Feb 84.** Powell, R.C. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). 28 Feb 1984. 37p. NTIS, PC A03/MF A01.

This report describes research on the crystal growth and spectroscopic properties of 4d and 5d transition metal ions in halide and oxide hosts materials. Specific information is given on the fluorescence spectra and lifetimes of divalent Rh, Ru, Pt, and Ir ions in KBr and KCl crystals using time-resolved laser pumping. Differences in spectral properties of charge transfer and d level emission are reported as a function of temperature, annealing and radiation treatments. The spectral properties appear to be suitable for laser materials if higher concentrations of doping can be achieved.

38127 **(AD-A—138332/2) Study of optical amplification in a double heterostructure GaAs device using the density matrix approach. Technical report.** Tavis, M.T. (Aerospace Corp., Los Angeles, CA (USA). Electronics Research Lab.). 15 Dec 1983. 82p. (TR—0084(4925-03)-1). NTIS, PC A05/MF A01.

A theoretical investigation of traveling wave light amplification in a GaAs double heterostructure device is presented in this report. The analysis is self-consistent and semiclassical, and uses a density matrix formulation. Phenomenological constants are included to account for intraband relaxation processes, pumping, and spontaneous emission. The analysis is significantly different from previous rate equation approaches in that saturation effects are inherent in the results and phase information, important for coherent applications, is retained. Results presented for steady state and pulsed operation include gain, pulse compression, multi-pulse effects, and the phase variation that occurs over the pulse time.

38128 **(AD-A—140362/5) Investigations of vacuum ultraviolet and soft X-ray lasers. Final report 15 May 82-14 May 83.** Elci, A. (New Mexico Univ., Albuquerque (USA). Inst. for Modern Optics). Mar 1984. 71p. NTIS, PC A04/MF A01.

The regimes in which an X-ray free electron laser can be operated are discussed. One possible use of an X-ray laser to nuclear spectroscopy is described. Intense field effects on nuclear beta decay are analyzed.

38129 **(DOE/DP/40169—T1) KrCl lasers for fusion. Final report.** (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). 31 May 1984. Contract AC08-81DP40169. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84012210.

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The lasing characteristics of the Krypton Chloride excimer have been investigated in an e-beam laser facility. The results of experiments have been compared with the predictions of a comprehensive numerical kinetics model. The model predicts that the formation efficiency for KrCl* should be quite high ($\approx$ 20%) and these predictions appear to be borne out by experimental gain measurements. However, observed intrinsic laser efficiencies are poor, about 1 percent being the best observed in this program. We conclude that the poor lasing performance results from an adverse gain to loss ratio and an extreme sensitivity to optics losses because of the low characteristics magnitude of the gain.

38130 **Photodissociation of 1,2-chloroiodoethane at 248 and 266 nm: The enthalpy of formation of CH_2ClCH_2I.** Minton, T.K.; Felder, P.; Brudzynski, R.J.; Lee, Y.T. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **81**: No. 4, 1759-1769(15 Aug 1984). Contract AC03-76SF00098.

The technique of photofragmentation translational spectroscopy has been utilized to study the photodissociation of CH_2ClCH_2I at excitation wavelengths of 248 and 266 nm. The primary photofragments are C_2H_4Cl and either $I^*(^2P_1/sub\ //_2)$ or $I(^2P_3/sub\ //_2)$. A fraction of the chloroethyl radical product contains enough internal excitation after the primary process to undergo secondary dissociation into C_2H_4 and Cl. By observing the threshold for this secondary process, the reaction enthalpy for $CH_2ClCH_2I \rightarrow C_2H_4 + Cl + I$ was determined, which leads to: $\Delta H^o/sub\ f/,0\ (CH_2ClCH_2I) = -7.8 +- 1$ kcal/mol. The c. m. translational energy distribution of the photofragments was derived for both the I* and I channels, yielding I*/I branching ratios of 1.5 at 248 nm and 3 at 266 nm. The translational energy distribution also revealed that about 50% of the excess energy went into translation. The angular distributions of dissociation products with respect to the laser polarization indicate that the primary photodissociation process for the ground and excited state iodine channels at both wavelengths proceeds via a parallel transition, i.e., the transition moment must be nearly parallel to the C—I bond.

38131 **Quasi-metastable quartet levels in alkalilike atoms and ions.** Harris, S.E.; Walker, D.J.; Caro, R.G.; Mendelsohn, A.J.; Cowan, R.D. (Edward J. Ginzton Laboratory, Stanford University, Stanford, California 94305). *Optics Letters;* **9**: No. 5, 168-170(May 1984).

We describe the properties of a subclass of quartet levels of alkalilike atoms and ions that often retain metastability against autoionzation and may have large radiative yields. Gain cross sections for XUV lasers with wavelengths between and 20 and 100 nm are given.

38132 **Fourier-transform ring laser.** Sklar, E. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of the Optical Society of America A: Optics and Image Science;* **1**: No. 5, 537-540(May 1984).

A Fourier-transform ring laser has been designed and toleranced to produce a good-quality beam from a solid-state laser. Extremely high volumetric utilization of the gain distribution is accomplished by injecting a super-Gaussian-shaped beam profile of uniform phase and nearly uniform intensity into the ring resonator. This beam fills most of the rod and is reproduced at the rod center in both intensity and phase by an exact Fourier-transform relay lens scheme. The laser is shown to be most stable when the diameter of the super-Gaussian beam is equal to diameter of the eigenmode for the optical system. It is shown to be most reliable when the relay system has a magnification such that the beam expands from its initial eigenmode size to fill the rod on its final pass.

38133 **Theory of nonreciprocal effects in a ring laser subjected to a transverse magnetic field.** Zhavoronkova, T.V.; Savel'ev, I.I.; Khromykh, A.M. *Soviet Journal of Quantum Electronics (English Translation);* **13**: No. 12, 1550-1555(Dec 1983).

Equations are derived for the description of steady-state multimode operation of a ring laser in an arbitrarily oriented magnetic field in the case when the resonator anisotropy is much stronger than the anisotropy of the active medium induced by the magnetic field. The transverse component of the magnetic field gives rise to nonreciprocal effects of two types: one of them is a polarization nonreciprocal effect which is due to a difference between the coefficients describing the nonlinear interaction of waves in an active medium and which depends on the ellipticity Epsilon of the radiation as $Epsilon(1-Epsilon^2)/(1+Epsilon^2)^2$; the other is a dispersion nonreciprocal effect which is due to an asymmetry of the frequencies of the opposite waves in the ring laser relative to the gain curve and which, in contrast to the former effect, is observed in the case of linear and circular polarizations of the radiation. Computer calculations are reported of the dependences of these effects on the intensity and direction of the magnetic field in the case of active medium and resonator parameters of the kind usually encountered in experiments.

38134 **Optically controlled two-component heterojunction laser.** Goldobin, I.S.; Luk'yanov, V.N.; Solodkov, A.F.; Tabunov, V.P.; Pushkina, T.N.; Yakubovich, S.D. (All-Union Scientific-Research Institute of Optophysical Measurements, Moscow). *Soviet Journal of Quantum Electronics (English Translation);* **13**: No. 12, 1629-1630(Dec 1983).

Hard switching-on and bistable operation were observed when an optical signal was applied to a weakly injected region of a two-component (GaAl)As heterojunction laser in a state close to the self-excitation threshold under continuous pumping conditions. A purely optical flip-flop operating regime with switching fronts of about 1 nsec duration and 4 mW amplitude, as well as a regime of generation of subnanosecond optical single pulses, were realized. The amplitude of the optical control signal was estimated to be below 0.1 mW.

38135 **Thermally excited CO_2 cascade lasers.** Biryukov, A.S.; Karakhanova, I.V.; Konoplev, N.A.; Shcheglov, V.A. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Soviet Journal of Quantum Electronics (English Translation);* **13**: No. 12, 1631-1633(Dec 1983).

Calculations are reported of the energy parameters of pulse-periodic gasdynamic CO_2 cascade lasers. Practical recommendations are given on the selection of the optimal resonator length in the downstream direction, of the optimal composition of the mixture, and of the optimal repetition frequency of Q-switching pulses.

38136 **Mode locking in a neodymium glass laser with a plasma mirror.** Hribek, P.; Kubecek, V.; Vrbova, M. (Czech Technical University, Prague, Czechoslovakia). *Soviet Journal of Quantum Electronics (English Translation);* **13**: No. 12, 1637-1638(Dec 1983).

An investigation was made of a superradiantly triggered neodymium glass laser system emitting quasicontinuously trains of 20 +- 4 psec pulses. Stimulated Brillouin backscattering is probably responsible for the plasma reflectivity causing mode locking.

38137 **Spectral and polarization hole burning in neodymium glass lasers.** Hall, D.W.; Haas, R.A.; Krupke, W.F.; Weber, M.J. (Lawrence Livermore Nat'l. Lab., Univ. of California, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **19**: No. 11, 1704-1717(Nov 1983).

Gain saturation in short-pulse glass laser amplifiers is treated including both spectral and polarization hole burning. Site-to-site differences in energy levels, transition probabilities, and orientations of the lasing ion in glass result in a distribution of stimulated emission cross sections and selective deexcitation of subsets of ions by a laser beam. These spectroscopic inhomogeneities are described by simple models whose parameters include the average emission cross section, the ratio of homogeneous-to-inhomogeneous linewidths, and the polarized cross section ratio. Performance of amplifiers based on the model media is calculated. Values for parameters to model an actual laser glass are obtained from standard fluorescence measurements and from resonant fluorescence line-narrowing (FLN) experiments. The predicted gain of a Nd-doped laser glass (ED-2) is compared to published amplifier measurements. The good agreement obtained demonstrates that data from FLN experiments provide sufficient information to model the performance of a glass amplifier in the large-signal gain regime. The results can also be used to guide the selection of glasses for increased energy extraction efficiency. Optimization of laser performance by varying parameters through changes in the host glass composition is discussed.

38138 **Optically pumped ultraviolet and infrared lasers driven by exploding metal films and wires.** Jones, C.R.; Ware, K.D. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 160-166(1983).

The 342-nm molecular iodine and 1315-nm atomic iodine lasers have been optically pumped by intense light from exploding-metal-film and exploding-wire discharges. Brightness temperatures for the exploding-film discharges were ~25,000 K and for the wire discharges were ~30,000 k. For the I_2 laser the 3.5-cm diameter by 40-cm long pumped volume lies adjacent to the wire or film of the same length. Pressures of 1-6 torr I_2 and 1-3 atm SF, CF_4, or Ar were used in the stainless-steel cell. Using 20-μF capacitance charged to 40 kV, a 0.25-mm tungsten wire, 3-torr I_2, and a 2-atm SF_6, an energy of 2 J was obtained from the laser in a pulse of 8-μs duration. The specific output energy was 7 J/l. Substitution of a cylindrical Al film for the wire, under otherwise similar conditions, led to a X10 output energy reduction. With an active volume and wire of 70-cm length greater output energies and efficiencies were obtained with similar input energy. An output pulse of 12 J and 12-μs duration was measured for a specific output energy of 18 J/l. A laser energy of 110 J in a 20-μs-long pulse has been measured from atomic iodine using a wire discharge along the axis of a larger cell. The active volume available was 20 cm in diameter and 80 cm in length. Input energy was 32 kJ. In similar measurements using a cylindrical Al film for discharge initiation, the measured output energy was 40 J. 2 references, 5 figures.

38139 **High-repetition-rate Raman amplification of 16-μm radiation.** Kurnit, N.A.; Watkins, D.E.; York, G.W. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **380**: 173-180(1983).

High-repetition-rate generation of up to 325 mJ of Raman amplified radiation near 615 cm^{-1} has been demonstrated in CO_2-pumped para-H_2 using a low-power, microwave-shifted CF_4 laser as an input Stokes seed source. Experiments were limited to 200 Hz, but single-shot Schlieren measurements indicate that our flowing room-temperature 44-pass Raman converter should be capable of the design goal of 1 kHz. Strong conversion was achieved even with no flow at 100 Hz. Details of the overall system design, experimental parameters, and present system limitations are discussed. 19 references, 8 figures.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 42040037675, 38377

38140 **(AD-A—140847/5) Heat transfer measurements of internally finned rotating heat pipes. Master's thesis.** Nefesoglu, A. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1983. 103p. NTIS, PC A06/MF A01.

A rotating cylindrical heat pipe was tested using various internally finned condensers and was compared with a smooth-wall cylinder. Each condenser was tested at rotational speeds of 700, 1400 and 2800 rpm with film condensation. Distilled water was used as the working fluid. The heat transfer rate of each condenser was plotted versus the driving temperature difference between the vapor saturation temperature and the cooling water inlet temperature. The objective of this investigation was to study the performance with various fin configurations and to find an optimum fin geometry. As expected, in all cases, performance was improved with increasing rpm. The performance of internally finned condensers was found to be as much as 230 percent greater than that of the smooth condenser.

38141 **(BMFT-FB-T—84-070) Examination of temperature and humidity on a near-surface district heating channel.** Weinspach, P.M.; Steiff, A.; Poggemann, R.; Hugo, H.; Buthmann, B. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.)). May 1984. 151p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751936.

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The influences of earth covering (heap), climate and aeration on temperature and humidity conditions in a near-surface district heating channel were examinated. The examination was carried out experimentally by measuring the conditions of the system within a period of one and a half years. For theoretical calculations a mathematical model was formulated and a calculation program was developed which can predict the gradients of temperature and steam content including the heat losses in the channel as a function of the most important parameters. The calculations coincide in the comparable region with the experimental results. They show that the air temperature and relative humidity in the channel were, just as the heat losses, significantly influenced by the temperatures of the medium and the environmental air conditions whereas the influence of the heap is low. With a heap of more than 0,2 m no more temperatures below the new point were detected.

38142 **(BMFT-FB-T—84-077) Energy saving in central heating plants. Influence of heating system flow temperature on energy consumption and heat transfer of radiators.** Kast, W.; Klan, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1984. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84751937.

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Rating of radiators: The reduction of the temperature of heating medium from tm = 80°C to 25°C affects differently rating and heat transfer according to the proportions of radiant and convective heat transfer. All commonly known types of heat-distributing units may be used, correct design provided. The increase of heat exchanging area of the heating unit is determined by the exponent of the exponential performance characteristic. Energy consumption of heating systems at different medium temperatures: Low temperature heating systems with simultaneously increased exchanging areas at steady-state operation have turned out not to affect indoor heat transfer, conserving energy only at conversion and distribution. In spite of different temperature distributions of the air in each room thermal comfort could be obtained by all systems excepting the ceiling panel heating because of too high temperatures near the head, and the air heating system because of the absence of radiation. Five heating systems in occupied unvented of-

fices have been experimentally investigated at interrupted operation during the heating period 1982/83 by computer-operated automatic local control. The presented differences in energy consumption and thermal comfort may be affected by other boundary conditions, control systems and user's behaviour (e.g. ventilating).

38143 **(BNL—34924) Vertical channel free convection for a power law fluid with a constant heat flux.** Irvine, T.F. Jr.; Schneider, W.J. (State Univ. of New York, Stony Brook (USA). Dept. of Mechanical Engineering; Brookhaven National Lab., Upton, NY (USA)). 08 Aug 1984. Contract AC02-76CH00016. 8p. (CONF-840816—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014551.

From 22. national heat transfer conference; Niagara Falls, NY, USA (5 Aug 1984).

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The development of free convection in a purely viscous non-newtonian fluid under the influence of a uniform wall heat flux is investigated. A finite difference solution is presented of the velocity and temperature profiles for the flow of an Ostwald-de Waele (power law) fluid between two symmetrically heated vertical plates. The flow, temperature and heat transfer characteristics of the channel are presented in a dimensionless manner as related to the generalized Grashof and Prandtl numbers and the fully developed flow range is established. The numerical solutions for the developing flow are shown to approach two classical asymptotes - fully developed duct free convection at low Rayleigh numbers and two independent vertical plates at high Rayleigh numbers. A comparison is made between the results of this theoretical investigation and previously published analytical and experimental work on newtonian and non-newtonian fluids. The results and their application to engineering problems are discussed. The changes caused by the addition of soluble substances to water cause significant variations in the mean flow between the plates and in the outlet temperature.

38144 **(NP—4770425) Changes of phase and waves on depressurization of liquids with high specific heat.** Chaves, H. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). 1984. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770425.

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The high specific heat of molecular complex substances has, at high temperatures the effect that the energy for the phase change liquid-gas is not the predominant factor in the energy balance of an adiabatic expansion of saturated liquid. Therefore it is possible to completely evaporate a liquid of large specific heat by adiabatic expansion. Expansion experiments were carried out in a duct of constant cross-section using a substance of high specific heat. In the case of a quick depressurization the phase change is coupled to superheat of the liquid and to differing wave speeds in the liquid and in the two-phase mixture. This difference causes a splitting of a wave running into liquid in a fast forerunner wave and a slow evaporation wave, in which part of the phase change takes place. This "wave-splitting" was observed in the experiments. It is shown that the speed of the forerunner wave corresponds to the sound speed of the liquid and that its amplitude is limited by nucleation processes. It is also possible to predict the wave speed and pressure jump of the evaporation wave treating this wave front as a normal detonation. A correspondence was found between the measurements and the calculations of the pressure levels for the sonic state and for the transition from mixture to gas flow. A comparison between the results obtained with a duct of constant cross-section and those with a duct of diverging cross-section, shows that "wave-splitting" is a purely local thermodynamic phenomenon and is independent of geometry.

38145 **The effects of heat generation and wall interaction on freezing and melting in a finite slab.** Cheung, F.B.; Chawla, T.C.; Pedersen, D.R. (Reactor Analysis and Safety Division, Argonne Nat'l Lab., 9700 S. Cass Avenue, Argonne, IL 60439). *International Journal of Heat and Mass Transfer;* **27**: No. 1, 29-37(Jan 1984).

The processes of freezing and melting occurring in a heat-generating slab bounded by two semiinfinite cold walls is studied numerically. The method of collocation is employed to solve the various sets of governing equations describing the unsteady behavior of the system during different periods of time. Depending on the rate of internal heat generation and the thermal properties of the wall and the slab, several changes may take place in the system. These changes, as indicated by the transient locations of the solid-liquid interface, include transitions from freezing directly to melting, from freezing to cooling without phase change, from cooling to heating without phase change, and from heating to melting. Numerical predictions of the occurrence of these transitions, the rates of freezing and melting, and the duration of the transients are obtained as functions of several controlling dimensionless parameters of the system. Comparison is made with the case of a heat-generating sphere to further explore the effect of system geometry.

38146 **Two-phase vessel blowdown of an initially saturated liquid—Part 2: Analytical.** Hutcherson, M.N.; Henry, R.E.; Wollersheim, D.E. (Senior Mechanical Engineer, Assoc. Mem ASME). *Journal of Heat Transfer;* **105**: No. 4, 694-699(Nov 1983).

Analytical models are presented to predict the internal vessel conditions during the decompression regimes of an initially saturated liquid. A subcooled blowdown analysis considers the elasticity of both the liquid and vessel. A bubble growth analysis for the intermediate period of blowdown is based on thermally dominated bubble growth from a solid surface into a superheated liquid. A dispersed analysis for the large decompression period assumes the vapor bubbles have grown sufficiently so the liquid is uniformly distributed within the vapor phase. The subcooled analysis predicts the initial period of blowdown reasonably well. The bubble growth analysis predicts the rise in system pressure above that value to which it initially falls after the end of subcooled blowdown. It considers an initially "slow" depressurization rate (less than 400 MPa/s) where nucleation and bubble growth is the dominate volume producing, and thus pressure recovery, mechanism. It provides insight into why the system pressure initially drops below the saturation pressure, and it also offers an explanation for the subsequent recovery of the system pressure toward the saturation pressure. The thermodynamic equilibriuim analysis provides a reasonable prediction of the latter stage of decompression. The combination of these three models predicts the overall two-phase decompression phenomenon reasonably well.

38147 **Experiment and analysis of instability of tube rows subject to liquid crossflow.** Chen, S.S.; Jendrzejczyk, J.A. (Argonne National Lab., IL). *Transactions of the ASME (American Society of Mechanical Engineers);* **49**: 704-709(Dec 1982).

A tube array subjected to crossflow may become unstable by either one or both of the two basic mechanisms: velocity mechanism and displacement mechanism. An experimental and analytical study of tube rows in liquid crossflow is performed to verify the existence and transition between the two mechanisms at the intermediate values of mass-damping parameter. Experimental data and analytical results are found to be in good agreement. 7 references, 9 figures, 1 table.

4205 Materials Testing

38148 **(MLM-MU—80-62-0023) Helium bombardment leak testing of the closure disk weld for MC2949, MC3004, and MC3095 pyrotechnic devices.** Dudley, W.A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 31 Mar 1980. Contract AC04-76DP00053. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014800.

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A helium bombardment leak test procedure was developed to determine the leak level of the closure disk weld performed on three nearly identical pyrotechnic actuators. The inspection procedure is capable of leak testing any of the three product types at a rate better than 120 units per 8-hr work shift. Testing is performed on a 100% sample plan and employs a go/no-go bombardment leak rate acceptance specification of 3×10^{-9} atm-cm^3-sec^{-1}. In addition to the current test procedure and results, this report includes a description of procedure and results associated with the test as initially performed. Other applications of the current technique are also listed.

38149 **(SAND—83-1034) Determining sample sizes for diversified reliability test programs.** Mueller, F.W. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015003.

This paper develops criteria for planning test programs that consist of diversified types of tests. Criteria using classical confidence limits are developed first, based upon the classification of failure mechanisms in terms of the number of tests that provide opportunities for their observation. The classical criteria suffer because of the small numbers of opportunities afforded some classes of failure mechanisms to display themselves; therefore, additional criteria are developed that use generic test experience in an Empirical Bayes sense. Application of the criteria is illustrated with an example.

38150 **Pulsed High-Energy Radiographic Machine Emitting X-Rays (PHERMEX): applications to study high-pressure flow and detonation waves.** Dick, R.D. (Los Alamos National Lab., NM). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **312**: 66-81(1983).

PHERMEX, an acronym for Pulsed High-Energy Radiographic Machine Emitting X-Rays, has been used as a diagnostic tool to make quantitative measurements from radiographs of inert materials under dynamic high-pressure conditions and of explosives during the detonation process. In some experiments, radiography is the best method (compared to high-speed optical cameras and contactor pins) to study complicated hydro-dynamic flow occuring in a dynamic experiment. To demonstrate the versatility and uniqueness of PHERMEX and the radiographic method, several experiments on inert solids having high and low atomic numbers will be discussed with some particulars. This includes the observation of the 11.0-GPa-pressure phase transition for antimony and the accompanying two-shock structure and the off-Hugoniot data for lead using regular reflection. Also, by careful design of a radiographic experiment, the Hugoniot state behind a shock front can be completely and precisely specified. Aluminium is an example of a material studies in this manner. PHERMEX is useful in studying some detonation properties of explosives. As an illustration, the discussion will include radiographic results of divergence characteristics of a detonation wave in sensitive explosives as it propagates past a corner and the effect of preshocking on the detonation process of insensitive explosives when the detonation wave interacts with a region that has been shock-compressed at a pressure too low to cause detonation.

4206 Safety Engineering

38151 **(NUREG/CR—3848) Experimental investigation of unsteady tornadic wind loads on structures.** Jischke, M.C.; Moslehi, F. (Oklahoma Univ., Norman (USA). School of Aerospace, Mechanical and Nuclear Engineering). Jun 1984. 84p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number TI84901565.

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Ward's tornado simulator was used to model the effects of a tornado-like vortex on a cylindrical model structure. The cylindrical model, intended to represent a containment building of a nuclear reactor, is a circular cylinder 17 cm in height and 11.4 cm in diameter with a hemispherical roof. The experiment was conducted at swirl angles of 0° and 45°. Pressure coefficients were measured at different locations on the model for steady and unsteady cases, corresponding to situations where the relative velocity between the vortex and model is zero and nonzero. Results are presented in the forms of sectional pressure coefficient profiles, and sectional force coefficients. Pressure profiles show that there are significant differences between the steady and unsteady results. Translation of the model through the simulator produces a more symmetric pressure distribution, and also results in a more substantial pressure drop on the model. It is observed that in a flow with swirl angle of 45°, translation causes a significant increase in the horizontal sectional force coefficient. Outside of the core region, translation causes an increase in the axial sectional force coefficient. The formation of very low pressure regions over the top section of the structure leads to very strong axial force coefficients. This may cause the failure to first appear on the roof, and then propagate throughout the structure and cause total failure. 38 references, 15 figures.

38152 **(PTB-W—22) Breathing process on storage tanks for inflammable liquids caused by atmospheric influences.** Foerster, H.; Schampel, K.; Steen, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Waerme). Jan 1984. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84751911.

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For the design of pressure compensation devices and inert gas fittings for storage tanks with inflammable liquids the breathing volume flow rates which are influenced tank heating due to the exposure to sunlight and tank cooling due to rain, play an important role. In order to establish a defined basis for the design of such devices which is effective with regard to safety engineering, the resulting maximum breathing volume flow rates for vertical cylindrical tanks, are estimated with the aid of model calculations. In the case of heating processes the resulting volume flow rates for given tank volumes are to be differentiated according to the geometry of the tank as well as the kind and condition of the tank coating. On the basis of model calculations, design values for venting devices are proposed which for larger tanks of the flat type are in some cases considerably higher than the values at present generally applied in practice. Parameters depending on atmospheric conditions such as the initial temperature of the tank atmosphere, the rainwater temperature, the rain flow density as well as the prevailing wind velocity are decisive for the cooling process. The frequency of occurrence of certain parameter combinations and the resultant volume flow rates can be estimated only roughly. For the conservative design of venting devices it is proposed to start from extreme atmospheric conditions scarcely to be expected in Central Europe once in a hundred years. In this case design values result which do not exceed the values at present generally applied in practice and which, in a comparison, show marked reductions of more than 30% only in the case of relatively small tanks.

4207 Vacuum Engineering

38153 (INIS-SU—212, pp 3-8) **High-vacuum pumping out of hydrogen isotopes by compressed and electrophysical pumps.** Bychkova, A.D.; Ershova, Z.V.; Saksaganskij, G.L.; Serebrennikov, D.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780224.

In General and nuclear physics.

To explain the selection of parameters of vacuum systems of projected thermonuclear devices, experiments are performed on the pumping-out of deuterium and tritium by high-vacuum pumps of different types. The values of the fast response of turbomolecular, diffusion vapour-mercury, magneto-discharge and titanium getter pumps in the operation pressure range are determined. The rate of sorption of hydrogen isotopes by non-spraying gas absorber of cial alloy depending on the amount of the gas absorbed and temperature, is measured. Gas current is determined by the pressure drop on the diagram of the known conductivity. Individual calibration of manometric converters for different gases using a mercury burette is performed preliminarily. The means of high-vacuum pumping-out that have been studied have the following values of fast response for tritium (relatively to protium): turbomolecular pump-0.95; evaporation getter pump-0.25; magneto-discharge pumps-0.65-0.9; cial alloy-0.1...0.5.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 42080038360

38154 **(ITEF—92(1982)) Semiautomatic system for manufacturjng printed circuit photomasters (SHABLON). Hardware and software.** Averchenkova, N.A.; Bobchenko, B.M.; Vasil'ev, V.M.; Karabel'nikova, M.R.; Lyulevich, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701612.

The paper deals with the structure and arrangement of hardware and software for an automatic system of manifacturing photomasters and drilling printed circuits developed on the base of VT-1010B minicomputer. The software of the "SHABLON" system is a set of applied codes. All the applied codes are written in the assembler VIDAS language for the VT-1010B computer. Each applied code or a group of codes solve one functionally complete problem which assures realization of some or other operation on manufacturing photomasters for printed circuits, i. e. the structure of the SHABLON system software corresponds to one-by-one division of photomaster manufacturing operations.

38155 **Where is the Poynting vector in an ideal transformer?.** Newcomb, W.A. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550 and Department of Applied Science, University of California, Davis, California 95616). *American Journal of Physics;* **52**: No. 8, 723-724(Aug 1984). Contract W-7405-ENG-48.

A simple calculation is presented verifying consistency of the Poynting theorem with the result of elementary circuit theory, in regard to the power flow across an ideal transformer. It is found that a nonzero Poynting vector is inevitably accompanied by certain departures from ideal behavior. Nonetheless, the use of ideal-transformer circuit relations is found to be justified as an asymptotic approximation in the low-frequency limit.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 42090037110, 37111, 37112

4210 Combustion Systems

38156 **(N—8330059) For operation of the Computer Software Management and Information Center (COSMIC).** Carmon, J.L. (Georgia Univ., Athens (USA)). Apr 1983. 28p. (NASA-CR—172903). NTIS, PC A03/MF A01.

Computer programs for large systems of normal equations, an interactive digital signal process, structural analysis of cylindrical thrust chambers, swirling turbulent axisymmetric recirculating flows in practical isothermal combustor geometrics, computation of three dimensional combustor performance, a thermal radiation analysis system, transient response analysis, and a software design analysis are summarized.

4230 Marine Engineering

38157 **(MITSG—83-7) Design against collision for offshore structures.** Mavrikios, Y.; de Oliveira, J.G. (Massachusetts Inst. of Tech., Cambridge (USA). Sea Grant Coll. Program). Apr 1983. 178p. Sea Grant Marine Information Center, MIT Sea Grant College Program., Cambridge, MA 02139 . Order Number TI84901435.

The force deflection curve for a rigid-plastic circular cylinder subjected to transverse loading applied by a sharp wedge is derived following an energy approach. A local deformation field is assumed and global deformation of the cylinder acting as a beam is neglected. The concept of the moving hinge with no slope discontinuity is used. The effects of the global deformation of the cylinder are then taken into consideration, and the overall force-deflection curve of the member acting as a beam is calculated. The above obtained force-deflection curve, in combination with the equivalent curve for a ship's bow, and also the foundation stiffness of a platform are used as spring data for a simplified two-mass dynamic model with linear and nonlinear springs. This model is then used to determine numerically the plastic deformation on one platform member (leg or brace) due to a collision with a ship. Finally a method is outlined for a cost-benefit analysis of a minor collision versus strength of a platform, using probabilistic data on the risk of such a collision, and the platform's damage calculation method presented above. 33 references, 45 figures, 5 tables.

38158 **(PB—84-157262) Local scour and scouring protection of drilling platforms in the Arctic Sea environment.** Rytkoenen, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Laivatekniikan Lab.). 1983. 91p. NTIS, PC E05/MF E01.

Placing an obstruction, such as for instance an artificial island platform, on the sea bottom will cause a disturbance in the bottom equilibrium. As a result a local scour-deposit phenomenon may occur, which especially in sandbottoms can significantly reduce the stability of platform and cause nonuniform stresses over the design value may, in extreme cases, cause the failure of a whole structure. Being aware of the scouring phenomenon and undertaking the scouring protection measures already before the platform installation is in general more feasible than to try to repair damages afterwards. In the paper the local scouring due to waves and currents near the toe of gravity platforms is described.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 42400037528

38159 **(PB—84-186097) Performance of an electrostatically augmented fabric filter pilot plant. Report for May 80-Feb 83.** Viner, A.S.; Van Osdell, D.W.; Ranade, M.B.; Hovis, L.S. (Research Triangle Inst., Research Triangle Park, NC (USA)). 1984. 12p. NTIS, PC A02/MF A01.

The paper gives results of a preliminary analysis of the economic feasibility of a pulse-jet-cleaned electrostatically augmented baghouse or fabric filter (ESFF). The ESFF pulse-jet baghouse, designed for a gas/cloth ratio of 2.4 m/min, would have a total annual cost that is 30% lower than that of a conventional pulse-jet baghouse designed for a gas/cloth ratio of 1.2 m/min. Evaluation of the economics of a reverse-air-cleaned ESFF baghouse is still underway, as are further pilot-plant and laboratory studies designed to elucidate the mechanism of ESFF.

38160 **(PB—84-186923) Development of NOx control methods for glass melting furnaces. Annual report Aug 82-Jul 83.** Abbasi, H.A.; Khinkis, M.J.; Fleming, D.K. (Institute of Gas Technology, Chicago, IL (USA)). Sep 1983. 222p. NTIS, PC A10/MF A01.

The purpose of this work is to provide experimental data that would help the glass industry significantly reduce NOx emissions from natural-gas-fired melters. Experiments were carried out on a relatively large (2 million Btu/h fuel input) pilot-scale furnace at IGT using scaled melter ports. The glass tank load was simulated by a heat sink consisting of a top layer of molten glass. The furnace temperatures and port operating parameters were maintained within limits of commercial container glass operations. Significant reductions in NOx emissions were achieved by (1) decreasing fuel/air mixing rates; (2) burning about half the fuel with all the combustion air, and injecting the remaining fuel to mix with the flame downstream of this highly fuel-lean combustion zone; and (3) operating the furnace at close to stoichiometric conditions and adding ambient air to furnace exhaust gases to complete combustion. The results show that it may be possible to reduce NOx production in commercial glass melters, without adversely affecting the heat-transfer to the melt, by properly controlling the fuel/air mixing. These results were obtained on a pilot-scale furnace under simulated glass melter conditions and should be demonstrated on full-scale commercial melters before definitive conclusions can be drawn about the effectiveness of these NOx control methods.

43 PARTICLE ACCELERATORS

38161 (SLAC-PUB—3352) What can we expect from future accelerators. Panofsky, W.K.H. (Stanford Linear Accelerator Center, CA (USA)). Jun 1984. Contract AC03-76SF00515. 14p. (CONF-810774—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013512.

From Summer school on high energy particle accelerators; Batavia, IL, USA (13 Jul 1981).

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This talk covers a general but highly subjective overview of the expectation for new accelerator development. An updated version of the Livingston chart demonstrates the exponential growth in time of the equivalent laboratory energy of accelerators. A similar Livingston chart pertaining only to electron-positron colliders shows an exponential growth but in the past only one technology - electron-positron storage rings - have been responsible for this development. The question addressed is whether the type of exponential growth reflected by these two charts can be sustained in the future.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 43010038745, 38746, 38747, 38750, 38987, 39022, 39023

38162 (BNL—34913) Acceleration of polarized protons at the AGS. Ratner, L.G. (Brookhaven National Lab., Upton, NY (USA)). 30 May 1984. Contract AC02-76CH00016. 8p. (CONF-8405193—26). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014569.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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Spin physics in the past has provided an acid test of many models and theories and over the last decade has revealed new and unexpected phenomena to confront present day theories. This work received great impetus from the experiments at the ZGS, where for the first time multi-GeV polarized beams became available. This, in conjunction with polarized targets, allowed the complete specification of the initial quantum states in high energy proton-proton interactions and led to many startling new results. Although spin effects were important at the previously measured lower energies, practically all theorists felt that spin effects would become negligible at higher energies. Instead, the ZGS results showed in many cases even larger effects than those observed at lower energies. By the time the ZGS was shut down in 1979, high energy polarized proton projects were planned for KEK in Japan, SATURNE in France, and the AGS at Brookhaven. At present, serious thought is being given to high energy polarized proton beams at Fermilab, CERN, and indeed in planning for the Superconducting Super Collider. Today, I would like to describe the facility at Brookhaven and give you the present status of the project. We have been in the commissioning phase for the last three months on a part-time basis. To date we have injected 7 μA of polarized protons with 70% polarization. We have accelerated a peak of 6.4×10^9 polarized protons to 10.3 GeV/c and have made a first pass at correcting about a dozen imperfection resonances and two intrinsic resonances. We believe that this first tune gave us about an 80% polarization survival from injection to 10.3 GeV/c. The goal was to achieve 26 GeV/c polarized protons with about an 80% polarization survival and an intensity greater than 10^{10} per pulse.

38163 (CERN—83-03, pp 271-304) Evolution of control systems for accelerators. Crowley-Milling, M.C. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

The author reviews the development of control systems for accelerators. After an historical survey and a general introduction the hardware and software of such systems is described. As example the control system of the CERN SP5 is considered. Finally an outlook is given to future developments with special regards to the LEP storage ring.

38164 (IFVE-OI—82-178) Computation of the H-wave accelerating structure of ion linacs. Barsukov, A.B.; Dajkovskij, A.D.; Igoshin, V.B.; Portugalov, Yu.I.; Ryabov, A.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701543.

The paper describes the method of engeneering computatjon of H-wave acceleratipg strUctures, used for low energy heavy particle accelerators. For this aim the computer code SUPERFISH-1 has been used. The results of theoretical analysis for some cavitjes with longitudinal magnetic field are given as well as comparison between calculated and experimental resulst.

38165 (INIS-SU—236, pp 105-109) Ways of using new generation cyclotrons for experiments in nuclear physics. Stepanov, A.V.; Vakhrushin, Yu.P.; Vorogushin, M.F.; Gusev, O.A.; Malyshev, I.F. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The technical specifications of the six types of new generation 5-200 MeV cyclotrons designed for application in different branches of national economy and medicine are given. The possibility of using each of the types of cyclotron for experiments in nuclear physics of low and medium energies is discussed.

38166 (INIS-SU—236, pp 124-128) Design and operation experience of a microtron in Czechoslovakia. Shimane, Ch.; Vognar, M. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Desion and operation experience of a microtron, a bremsstrahlung source, in Czechoslovakia is considered. A beam extraction system from 16-th to 23-rd orbit is accomplished. The 23 MeV electron beam energy is obtained. Microtron operation experience for more than a year and a half has demonstrated its reliable operation. Besides sample activation and activation analysis the microtron deserves attention as a radiation source for biological objects. As for an operator the microtron require only small and not too frequent corrections of its performance.

38167 (JINR—9-83-317) Dubna synchrophasotron. Operation and improvement (quarter 4, 1982). Balandikov, A.N.; Beznogikh, Yu.D.; Brovko, O.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701567.

The data presented show the operation of the accelerator in the 4th quarter, 1982 and throught the year. To accelerate nuclei heavier than deuterons, the EBIS "Krion-1" is used as a source. The accelerated ^{12}C and ^{22}Ne nuclei have found application in physics experiments. As before, the "Krion-1" source is controlled by means of fibre-optical lines; to increase the reliability, a new system of synchronization of "Krion-1" is used. To analyze the nuclear composition of a beam at the output of th linac and in the slow extraction channel of the beam from the synchrophasotron, test specimens of the device on-line with a computer have been constructed. Measurement on the determination of the nuclear composition of a beam from the "Krion" source were made in operation run of the accelerator. The reconstruction of an accelerating system allowe the reliability of the operation of the synchrophasotron to be increased. Considerations used as a basis of the choice of construction and main parameters are presented. Geodetic measurements were carried out only for a group of bench marks.

38168 (JINR—D-9-82-664, pp 81-93) **Experiments on the ion collective acceleration in high-power electron beams at the AN USSR Institute for Nuclear Physics.** Ryutov, D.D. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

The results of experiments into the ion collective acceleration in high power electron beams with the method of "gas dynamic" acceleration (GDA) with the aim of application of ion beams with the atomic number 1a-20 for a plasma heating are given. Experimental installations KRAB, AQVAGEN, VODA-1-10 are described in which the electron accelerator operates in the regime of the "natural" (negative) polarity, and ion acceleration takes place under the effect of the electric field of oscillating electrons in the equipotential drift space from the outer side of the anode foil. The experiments have shown that the efficiency of energy transfer to the ion flux greatly increases due to decrease in the total thickness of anode foils. To have the high current density it is recommended to apply anode "sandwiches" that contain a layer of material with Z=100. It is also shown that GDA is also applied for the purposes of inertion containment of plasma. The focusing of heavy ion beams can be performed by their recharging in the "conical" magnetic field and their transformation in converting beams of neutral atoms.

38169 (JINR—D-9-82-664, pp 145-148) **Collective acceleration of ions in a vacuum by means of relativistic electron beam.** Didenko, A.N.; Logachev, E.I.; Lopatin, V.S.; Remnev, G.E.; Usov, Yu.P. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Ion acceleration in high current electron beam is studied. Dense plasma produced in the result of explosive emission on an earthed electrode (EE) is taken for the ion source. EE with the central aperture of 12-30 mm was made of polyethylene, graphite, teflon and metals (Li, Al, Fe, Nb, No, Ta). The measurements of ion energy have shown the similar rate of the ion beam front for all EE materials (0.5-0.6 MeV/a. e. m). In the range of ion acceleration a longtitudinal self field of the electron beam is found. The total number of heavy ions accelerated per pulse exceeds $2x10^{15}$.

38170 (JINR—D-9-82-664, pp 153-155) **Resonance excitation of a large amplitude slow Langmuir wave in a relativistic electron beam.** Bonch-Osmolovskij, A.G.; Dolya, S.N.; Reshetnikova, K.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Resonance interaction of a high current electron beam with the slowing down structure is considered for which a spiral wavequide is chosen which provides a great slowing down of electromagnetic wave. It is shown that external slow wave in spiral wave quide amplified by the electron beam can effectively accelerate ions at a relatively small energy of injection.

38171 (JINR—D-9-82-664, pp 194-196) **Study on the high-power ion beam production in a magnetic insulation diode filled with a plasma.** Bystritskij, V.M.; Volkov, S.N.; Krasik, Ya.E.; Petrov, A.V. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Results of investigations into the production of high-power ion beams in plasma-filled diode with magnetic field applied across anode-cathode gap are given. Magnetoisolated diode (MID) of the coaxial shape with the "squirrel wheel" type earthed diode of the 40 mm diameter and anode with the diameter of 74 mm is placed at high voltage accelerator. Nitrogen and hydrogen are used as working gases. The estimates of energy ranges for hydrogen and nitrogen ions are 170-300 keV and 50-170 keV with the bunching density of 20 A/cm^2 and 12 A/cm^2, respectively. Conclusions are made that in the case of filling with plasma MID anode-cathode gap with an unclosed electron drift the conductivity of the latter accross the magnetic field proves to be sufficient for the disappearance of anode-cathode gap and the production of high-power ion beams.

38172 (JINR—D-9-82-664, pp 209-211) **Ion production and bipolar fluxes in a high-current plasma-filled diode.** Ivanenkov, G.V. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

The model and the evolution of behaviour of binary layers (BL) in expanding plasma of high current plasma-filled diode are described. The model estimates ion current and the laws of plasma expansion at the stage of BL intensive growth. The density range (10^{12}-10^{15} cm^{-3}) is determined in which diode impedance growth takes place in connection with BL appearance. The density of ion current at the outlet of diode is 10 A/cm^2.

38173 (JINR—D-9-82-664, pp 215-217) **To the problem of electron beam production in plasma diodes.** Korenev, S.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

The results of exprriments on electron beam generation from plasma emitting surfaces formed by incompleted charged over the dielectric surface, sliding charge over the dielectric surface covered with a layer of barium oxide, discharge due to explosion-emission effects. The experiments have shown that the formed plasma of sliding discharge and discharge in explosion-emission effects is rather homogeneous and the electron beam has the current density homogeneity in the transverse cross section of approximation 20%. At the diode voltage of 150-300 kV the density of electron current for diodes with cathode on the basis of the sliding charge is approximately 0.4-1.0 kA/cm^2, while for diodes with cathode made of graphite with metallic grid it is approximately 0.5-1.3 kA/cm^2. The average gap between anode and cathode is 1 cm for both cases.

38174 (JINR—D-9-82-664, pp 62-65) **Computation of multicomponent electron-ion ring acceleration.** Kazarinov, N.Yu.; Perel'shtejn, Eh.A.; Shirkov, G.D. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Results of calculations of the acceleration of multicomponent electron-ion ring in the dropping magnetic field generated by two solenoids of the heavy ion collective accelerator are given. Relative polarizations of ion components and mean square dimensions of the electron ring are given. It is shown that polarizations of all ion components have the oscillation nature.

38175 (JINR—D-9-82-664, pp 149-152) **Collective acceleration of ions in the systems with a dielectric anode.** Bystritskij, V.M.; Didenko, A.N.; Logachev, E.I.; Lopatin, V.S.; Remnev, G.E. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Results of experiments into the determination of the relation of accelerator parameters to efficiency and reproducibility of accelerating processes are presented. The experiments are carried out in accelerators with the current of an electron beam of 20-50 kA, energy of 250-800 keV, beam pulse duration of 50-100 ns. Three types of cathodes are used. They are point, conic and ring cylindric cathodes. Dielectric and metallic lenses, cylindric and conic liners are placed inside the pumped-out chamber with the diameter and length of 30 cm. It is shown that the organization of multichannel rupture of anode surface brings about the increase of the maximum proton energy and improvement of repetition of the detected neutron yield. A group of protons making the bulk of the neutron yield

starts accelerating 50-60 ns after a voltage pulse is transmitted to diode. Efficiency of accelerating processes with dielectric and metallic lenses and with conic (conducting) with dielectric and metallic lenses and with conic (conducting) liners is close under condition of the optimum geometry selection. The reproducibility of the neutron yield from the lithium target for cathodes is similar and increases with voltage increase.

38176 **(JINR—R-9-83-193) Experimental investigation of a variant of an induction linear accelerator modulator part.** Dolbilov, G.V.; Krasnykh, A.K.; Razuvakin, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701558.

An induction linear accelerator (LA) modulating part with magnetic elements for power compression and nonlinear pulse shaping circuit is considered. The coefficients of compression and energy transfer in the elements including choking coils designed on the base of of LIU-5/5000 inductors as well as ferrite rings ar experimentally determined. The performed experiments show that the compresssion coefficient in a microsecond range constitutes 6-8. The energy transfer coefficient in the power range of several megawatts constitutes 0.8-0.9 Typical compression coefficients in the nanosecond range (up to 100 ns) constitutes 1.5-3. The energy transferred from element to element may constitute of the order of 10 J. It is concluded that the analysis of the obtained results gives a more rational approach to the LA modulator design.

38177 **(JINR—R-9-83-307) KUTI-20 collectiVe heavy ion accelerator. SILUND-20 running, control and diagnostics systems.** Dolbilov, G.V.; Dubovik, L.V.; Inkin, V.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701559.

The state of affairs in creating the KUTI-20 collective heavy ion accelerator is described. The systems of KUTI-20 injector-linear induction electron accelerator SILUND-20, the first turn of the running, control and diagnostics systems are described. The accelerating part consists of 5 sections including 24 inductors each. Each section is supplied from a generator with 600 MW pulsed power. Focusing system of solenoidal type provides the magnetic field in a highway upto 4 kOe. Metal-ceramic elements are used in the construction of the accelerating highway. The parameter running and control system is realized on the base of the SM-3 computer, ELECTRONIKA 60-microcomputer, KM-001 computer, CAMAC-standard apparatus. It has 52 channels for synchronizing the accelerator systems with 0-5 ms range of regulation and with step upto 1 ns. The system controls 100 accelerator parameters. At the exit of the SILUND-20 accelerator the electron beam with 1 kA current and 2 MeV energy has been achieved. The investigations of the electron beam in the weak focusing magnetic field of adhesator have shown that the energy spread is equal to (2.2+-1.6)%, and emittance (34+-12) mradxcm.

38178 **(KFTI—82-46) Polarization experiment automation system at the exit of the 2 GeV electron linear accelerator.** Gorbenko, V.G.; Kolesnikov, L.Ya.; Konovalov, O.G.; Karnaukhov, I.M.; Sorokin, P.V.; Slabospitskij, R.P.; Sukhomlin, E.A.; Storozhenko, Yu.O.; Chechetenko, V.F. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701571.

On the basis of the general system approach, the solution of the automatization problem of the polarization experiments at the outlet of linear electron accelerator LUEh-2 GeV, is outlined. The detailed analysis of problems is performed which must be solved by the automatization system; information currents from automatization objects are estimated; the composition of technical means is suggested, and the structure of the system is given. On the basis of the choice of structure to develop the system stage-by-stage; the main stages of work with respect to obtaining the maximum effectiveness from the introduction of the automatization system of polarization experiments are determined.

38179 (LA—9933-C-Vol.2, pp 548-561) **TRIUMF as an injector for a kaon factory.** Kitching, P. (University of British Columbia, Vancouver, Canada). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The current layout of the TRIUMF facility is briefly described. Three options for the design of a kaon factory are then described. The options are a cyclotron, a 15 GeV synchrotron and a 30 GeV synchrotron which would use ISR superconducting magnets. Possible site layouts for each option are shown.

38180 (LA—9933-C-Vol.2, pp 678-681) **Experimental requirements for kaon beams.** Schmidt, M. (Yale Univ., New Haven, CT). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The discussions of the working group concerned with experimental requirements for the design of charged and neutral beams to be used in the study of kaons decaying in flight are summarized. Prototypical experiments for the kaon factory served as a focal point for the discussions with an emphasis placed on recent experience. Several general conclusions were reached and numerous issues requiring detailed studies were raised.

38181 (LA—9933-C-Vol.2, pp 700-712) **Neutrino workshop report.** Carlini, R.; Burman, R.; Bowles, T.; Maschuw, R.; White, H. Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Neutrino beam lines, large neutrino detectors and a liquid butane time-projection chamber for neutrino-nuclei experiments were discussed during this workshop. Topics concerning beam lines which were addressed include: proton beam pulse structure and energy, target design, and beam monitoring. Requirements for detectors for neutrino-proton elastic scattering, neutrino-electron elastic scattering and neutrino oscillation experiments were reviewed and two detector designs meeting these requirements were proposed. Requirements for the liquid butane detector were also discussed.

38182 (LA—9933-C-Vol.2, pp 713-729) **High-intensity neutrino area for LAMPF and LAMPF II.** Carlini, R.D. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

This report constitutes a preliminary design study for a general-purpose high-intensity neutrino-experimental area which can utilize protons between the energies of 800 MeV and 32 GeV. This allows a very cost-effective approach to a long-term program of world-class neutrino physics at Los Alamos. The design discussed is based on the Fermilab "railroad system," where beam-line elements are placed in position and removed via transporters that enter the tunnel as needed. Also discussed are the fluxes, energy, and lengths and detector volumes for the two energies under considerations. High-energy narrow-band operation and low-energy time-of-flight correlation with the neutrino energy are also discussed.

38183 (LA—9933-C-Vol.2, pp 738-747) **Time-separated antiproton beam for LAMPF II.** Mayes, B.W.; Pinsky, L.S.; Mutchler, G.S. (Univ. of Houston, TX). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

For some years now efforts have been made to identify the interesting physics one could do with LAMPF II. This report represents the most recent look at a potential anti p facility for LAMPF II and a general look at the types of physics to which such a facility could be applied. Considerable discussion has tran-

spired at previous workshops regarding the fundamental options for anti p research: Time Separated Beams (TSB's) and Cooled Beams. It is clear that from a purely physics standpoint, Cooled Beams offer distinct advantages for certain classes of experiments. However, the tremendous cost disparity between a Cooled Beam (>50 M$) and TSB (~5 M$) makes a strong argument for a TSB as the first-generation LAMPD II anti p facility. The authors feel that a TSB will still allow the broadest range of anti p physics to be addressed, and if one keeps a Cooled Beam facility as an option for second-generation LAMPF II development, the strengths of both types of facilities may ultimately be realized at LAMPF.

38184 (LA—9933-C-Vol.2, pp 1037-1041) **Concluding remarks.** Thiessen, H.A. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Some important points coming from the 1983 LAMPF II Workshop are discussed. Among these are: the identification of required beam lines and beam energies and proposals for detectors. A staged approach to the construction of LAMPF II is then discussed and a proposal for the timing of construction of various facilities made.

38185 **(LBL—17990) Berkeley mini-collider.** Schroeder, L.S. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 11p. (CONF-8405193—29). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014594.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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The Berkeley Mini-Collider, a heavy-ion collider being planned to provide uranium-uranium collisions at T/sub cm/ ≦ 4 GeV/nucleon, is described. The central physics to be studied at these energies and our early ideas for a collider detector are presented.

38186 **(LBL—18026) Preliminary design implications of SSC fixed-target operation.** Zisman, M.S. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 9p. (CONF-840154—3). NTIS, PC A02; 3; GPO Dep. Order Number DE84014583.

From PSSC fixed target workshop; Woodland, TX, USA (27 Jan 1984).

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This paper covers some of the accelerator physics issues relevant to a possible fixed-target operating mode for the Superconducting Super Collider (SSC). In the brief time available, no attempt has been made to design this capability into the SSC. Rather, I have tried to evaluate what the performance of such a machine might be, and to indicate the hardware implications and extraction considerations that would be part of an actual design study. Where appropriate, parameters and properties of the present LBL design for the SSC have been used; these should be taken as being representative of the general class of small-aperture, high-field colliders being considered by the accelerator physics community. Thus, the numerical examples given here must ultimately be reexamined in light of the actual parameters of the particular accelerator being considered.

38187 **(RI—158) First in Europe. History of construction and pre-war years of the Radium Institute cyclotron. Part 2.** Alkhazov, D.G.; Shilov, V.P.; Ehjsmont, V.P. (Radievyj Inst., Leningrad (USSR)). 1982. 42p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701573.

The history of creation and development in pre-war years of the Radium Institute cyclotron - the first magnetic resonance accelerator made in Europe is given. The paper has been based on the materials of historical archives of the V. G. Khlopin Radium Institute, literary writings and personal memories of one of the authors. This publication is dedicated to 45-th anniversary of putting the cyclotron in operation and to 60-th anniversary of the Institute.

38188 **(SLAC/AP—29) Methods to increase linac efficiency.** Farkas, Z.D. (Stanford Linear Accelerator Center, CA (USA)). Apr 1984. Contract AC03-76SF00515. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014692.

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The average gradient of an accelerator section is proportional to the average power entering the section during its filling time. As an example the SLAC the gradient is one and two thirds the peak power. The linear collider requires a gradient of 21MV/m, hence 159 MW of peak power. We do not as yet have 159 MW klystrons, therefore we multiply, by means of pulse compression the peak power we do have, P/sub k/, by a multiplication factor 159/P/sub k/. This note presents methods to increase the compression efficiency so that the 21 MV/m gradient can be reached with a minimum of rf peak power, of rf average power, and of AC line power. It discusses the design of variable group velocity sections and it shows that by changing the group velocity gradient along the section, the variation of voltage with time can be used for beam loading compensation when the beam pulse width is less than the section filling time. 9 references, 15 figures, 2 tables.

38189 (JINR—R-1,2,13-83-81, pp 78-83) **Expected parameters of neutrino dichromatic beams on the IHEP accelerator.** Volkov, A.A.; Kotov, V.I.; Mukhin, A.I.; Rzaev, R.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780157. (CONF-820192—).

From 3. working conference on IPHE-JINR neutrino detector; Dubna, USSR (18 Jan 1982).

A mononeutrino (antineutrino production scheme is described. Calculation results for beam parameters and background conditions are presented. The channel is composed of parabolic lenses, pulse bending magnets and a collimator system. The given data show that in the existing IHEP neutrino channel on the basis of its target part it is possible to produce monochromatic neutrino (antineutrino) beams with admissible for experiment parameters and background conditions.

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REFER ALSO TO CITATION(S) 43020038188, 38277

38190 **(AD-A—140209/8) REB (Relativistic Electron Beam)/channel tracking experiments in low pressure ammonia. Memorandum report.** Murphy, D.P.; Raleigh, M.; Laikin, E.; Pechacek, R.E.; Greig, J.R. (Naval Research Lab., Washington, DC (USA)). 26 Mar 1984. 33p. (NRL-MR—5281). NTIS, PC A03/MF A01.

This document presents the results of an investigation of the interaction between an intense Relativistic Electron Beam (REB) and reduced density channels in ammonia (NH3) at 40 Torr. The channels were produced by absorption in the ammonia of energy from a pulsed CO2 laser. Two channel geometries were studied. The first employed a 2.5 cm radius channel with the nominally 1.2 cm radius REB injected coaxially. The second geometry employed an annular channel with its minimum density at 2.3 cm radius and near ambient density on axis. The REB was again injected coaxially. It was found that the conductivity induced in the reduced density channel by the REB caused large plasma currents to flow in the channel. The REB current and the plasma current flowed in opposite directions during most of the REB pulse, causing the REB to be expelled/repelled from the channel.

38191 **(BNL—34987) Fast quadrupole pulsed power supply in the AGS.** Nawrocky, R.J.; Halama, H.J.; Lambiase, R.F.; Montemurro, P.A. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 4p. (CONF-8406137—15). NTIS, PC A02; 3; GPO Dep. Order Number DE84014562.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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As part of the Polarized Proton Project at the AGS, a pulsed power supply system has been developed to energize a set of twelve fast quadrupoles which are symmetrically distributed around the 1/2-mile circumference of the machine. During a typical acceleration cycle, which is normally repeated every 2.4 s, these magnets are energized with bursts of triangular current pulses. The rise-time of each pulse is less than 2 μs and the width at the base varies from 1 to 3.5 ms depending on the pulse. Within a burst, pulses alternate in polarity and vary in amplitude from 160 A to 2700 A peak. Pulse separation is on the order of 40 ms. Due to the distributed nature of the load and high di/dt, each magnet is powered by a separate modulator. Magnets are driven via coaxial pulse transmission cables up to 200 ft long. In the modulators, the high power pulses are switched with thyratron/ignitron switch pairs. All modulators are charged in parallel with a common system of programmable high voltage power supplies. The overall system is controlled with a distributed network of microcomputers. This paper describes the development, construction and initial performance of the pulsed power supply system.

38192 **(FERMILAB/TM—1269) Minimizing the emittance in designing the lattice of an electron storage ring.** Teng, L.C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1984. Contract AC02-76CH03000. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015324.

For a synchrotron radiation facility to get high spectral brilliance it is desirable to have small emittance of the electron beam in the storage ring. Ways of improving beam emittance by optimizing the lattice are discussed.

38193 **(IFVE-OI—83-9) Computer simulation of high-current beam longitudinal motion in the initial part of a HF quadrupole focusing accelerator.** Budanov, Yu.A.; Mal'tsev, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701544.

An iteration algorjthm, which allows to study high current beam dynamics of longitudinal motion in the initial part of the accelerator with RF quadrWpole focusing with the help of numerical simulation has been described. Particle acceleration and focusing in the initial part of the accelerator are in the HF electric field between electrodes of the four-conductor line inside a special pesonator. Beam characteristics, obtained with numerical simulation are compared with experimental data on the 700 KeV initial part of the accele-- rator.

38194 **(IFVE-OMVT—82-196) Remarks on the magnetic-optical system automation. 2. Application of bending magnets for beam optics correction and control.** Volkov, B.S.; Kalinchenko, P.A.; MajoroV, A.A.; Samojlov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701545.

The method of magnetic-optical system control and correction based on measuring beam centre of gravity is discussed. The requirements imposed on the detectors and their location in the beam transport system are treated. Some examples are given. All the results have been derived in the framework of the first order theory. The described method for beam optics correction and control can be applied in all cases where some aperture margin exists. The advantage of the method is soft requirements for calibration measurements. Besides, the determination of the coordinate of the beam bending center in a correction magnet can be performed by noncontact detectors that is especially important in the cases when introducing a matter into the beam is not admissible due to radiation and other conditions.

38195 **(IFVE-OMVT—83-2) Method to calculate the Eigen electromagnetic fields in arbitrary shape cavities.** Portugalov, Yu.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701546.

The paper presents a method, proposed for calculation of Eigen frequencies and electromagnetic fields in cavities of an arbitrary shape. Approximation of equations for numeric solution of the problem is realized by the finite element method. Field components in local orthogonal coordinate system are used as independent variables. The efficiency of the method is demonstrated on the example of calculation of the nonsymmetric modes in axial symmetric cavities.

38196 **(IFVE-ORI—82-168) Radiation heating of super-high-energy accelerator units: physical aspects of the problem.** Mokhov, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701547.

It is shown that a number of macroscopic effects appear when high-intense proton beams of high energy interact with matter. A new complex of the MARS-9 programs for nuclear-electromagnetic cascade calculations is described. They are compared with other programs and experimental data. Some regularities of energy release field formation in targets, absorbers and superconducting magnets under irradiation by high-energy (up to 20 TeV) protons have been found. Tolerable beam sizes on the targets and absorbers are quoted together with the limitations for proton losses level at accelerating-storage complexes.

38197 **(IFVE-OUNK—82-133) Sextupolar and decapolar nonlinearities effecting particle betatron motion in an accelerating-storage complex.** Balbekov, V.I.; Chirkov, P.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701548.

The effect of sextupolar and decapolar nonlinearities of the bending magnets on the accelerating-storage complex dynamic characteristics is analyzed. One of the possible versions of the chromaticity correction system is selected with consideration of this effect. Tolerances on the nonlinearities of second and fourth orders are determined, moreover the central nonlinearities and the nonlinearities on the edges of the magnets are analyzed separately.

38198 **(IFVE-OUNK—82-135) Longitudinal dipole instability of bunches in a proton synchrotron with an azimuthal gap at a beam.** Gurov, G.G.; Malovitskij, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701549.

The longitudinal dipole coupled-bunch instability of the beam with an azimuthal gap is considered, the gap duration being greater than the filling time of a cavity, causing the instability. The phase motion of the bunches of beams with and without the gap is compared. The principal results are illustrated for the case of the IHEP accelerating storage complex, which is now under design.

38199 **(IFVE-OUNK—82-167) Optimization of the end parts of the superconducting dipoles of an accelerating-storage complex.** Balbekov, V.I.; Tkachenko, L.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701550.

Calculations for three-dimensional magnetic field of the superconducting dipole have been made. An optimal geometry for the magnet which provides zepo nonlipearities of the central and edge fields has been chosen. The influence of the magnetic circuit on the main field characteristics has been studied. Tolerances for the dipole geometrical sizes are given.

38200 **(INIS-SU—198, pp 377) Cyclotron beam synchronization.** Zalyubovskij, I.I.; Kuznichenko, A.V.; Lebedev, V.N.; Onishchenko, G.M.; Levon, A.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38201 (INIS-SU—211, pp 12-13) **Magnetic quadrupole lense for the 2 GeV linear accelerator with aperture 150 mm.** Artemov, V.I.; Dobromirov, S.A.; Peev, F.A. 1982. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780255.

In Technique of physical experiment.

To increase the acceptance of accelerating focusing channel of the LU-2 GeV linear accelerator, magnetic quadrupole lense with the aperture of 150 mm is prepared. This aperture permits to establish the lense in any place of accelerator, as well as directly on the case of accelerating section. The design is described, technical characteristics of the lense are given. Magnetic characteristics and harmonic composition of magnetic field of the lense are measured. The gradient of the magnetic field remains stable in the limits of 0.7 radius of the aperture and constitutes 0.9 Tl/m. The effective lense length is 356/nm with the geometrical length of 310 mm. The contribution of harmonics of higher orders in the limits of really used aperture part proves to be insignificant. The discrepance of magnetic and geometrical axes does not increase 0.5 mm.

38202 **(JINR—1-83-105) Estimating of relativistic nuclear beam composition at 4.2 GeV/c per nucleon momentum.** Martynov, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701561.

The admixture of nuclei with Z=1-5 is estimated in $^{12}C_6$ relativistic nuclear beam with 4.2 GeV/c per nucleon momentum. The nuclear charge is evaluated over intensity of delta-electrons accompanying the track of a beam particle. It is obtained that the admixture of boron nuclei (B_5^{10}, Z=5) and of He nuclei (He_2^4, Z=2) is, correspondingly, $k_5=N_0^5/N_0^6=(8.3+-2.5)\%$ and $k_3=N_0^3/N_0^6=(13.4+-3.9)\%$. The sum error for k_5 and k_4 is as high as 25% 30% The main contribution is due to the statistical error.

38203 **(JINR—9-83-144) Investigation of excitation of accelerated beam stretching system of "F"facility.** Glazov, A.A.; Zaplatin, E.N.; Kochkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701564.

As a stretching system of the accelerated beam of "F" facility it is proposed to use C-electrode with the 60 deg angular extension. The investigation of the excitation of the beam stretching system revealed that operating voltage on C-electrode equals 15 kV in the 60 kHz frequency range for 14.7 MHz resonance frequency, optimal length of the channel connecting the generator with the system is determined, some units of the system are optimized structurally. For excitation of the system a h.f. generator is designed for 10 kW of output power. The generator was investigated in two versions of output cascade.

38204 **(JINR—9-83-289) Simulation of sector magnets of supercyclotron (scale 1:5).** Zaplatin, N.L.; SamsonoV, E.V.; Chesnov, A.F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701565.

The experimental results obtained from the model of sector magnets of proton cyclotron with 800 MeV energy are described. It is shown that due to splits placed between the pole and the pole piece the divergence between average magnetic field and isochronous one decreases up to $25x10^{-4}$ T. The results of simulation of the current trim coils are considered. It is shown that in order to accelerate a beam without phase losses (25-30) coils should be used with maximum current (250-300) A. The results of particle dynamic numerical calculations in a formed magnetic field are discussed. It is shown that the beam space stability is provided all over the acceleration range.

38205 **(JINR—9-83-335) Azimuthal inhomogeneity of magnetic field in JINR synchrophasotron and correcting beam orbit over radius at the initial stage of acceleration.** Zabolotin, V.P.; Isaev, A.S.; Perfeev, I.N.; Frdukov, S.V.; Sherstyanov, D.I.; Tsarenkov, A.P.; Yalovoj, I.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701568.

Information is presented on the distribution of magnetic field H=160 Oe over magnet quadrant azimuth on R_o and R_o+-60 cm radii for 800 A current in demagnetization cycle, on amplitude value and position of the first harmonics of azimuthal symmetry of the magnetic field nd beam orbit distortion over radius, as well as on current values in correction coils which serve to compensate distortions. The magnetic field distribution over azimuth in linear gaps and on edges of the quadrants in the working region and outside it at H=160, 3000 and 11500 Oe is presented. The possibilities are shown of correcting the beam orbit distortions over radius at the initial stage of acceleration.

38206 (JINR—D-9-82-664, pp 20-22) **Ring currents in vacuum channels with dielectric walls and in magnetic insulation diodes.** Agafonov, A.V.; Orlov, D.B. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

To investigate the confinement of high current electron beam (HCEB) the behaviour of HCEB in a ring dielectric channel and in the inversion coaxial diode with magnetic isolation is studied. Ring dielectric channel is a long chamber formed by two equipotential coaxial cylinders. A rotating HCEB is placed between electrodes. There is plasma on the surface of external electrode. Ions drawn from a plasma pass through a cylindric electron layer and are slowed down by the field of the proper spatial charge and form a virtual ion anode in a certain point. It is shown that the increase in the energy of injected electrons brings about the decrease in the thickness of the electron layer and improvement in the electron confinement. The values of magnetic fields and stored energy in the coaxial diode with magnetic isolation are given.

38207 (JINR—D-9-82-664, pp 34-36) **Experimental study on the dynamics of ion storage in electron rings.** Sarantsev, V.P.; Inkin, V.D.; Mozelev, A.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Results of experimental investigations into the dynamics of ion storage in the electron rings on the prototype of a heavy ion collective accelerator of in JINR are given. To investigate the dynamics of ion storage an automatized system with fast reponse buffer memory and a system on the basis of the X- ray germanium detector is made. To determine the maximum value of the product of ions and electrons (Nsub(e)xNsub(i)) for the storage of nitrogen ions from residual gas the measurement of this value is made in the time range 2.3-2.5 ms from the moment of injection and the duration of time interval of counting 200 μs at the pressure in the chamber $1x10^{-17}$ torr. The maximum Nsub(e)xNsub(i) value was registered, which is $(7.5+-1.8)x10^{24}$.

38208 (JINR—D-9-82-664, pp 37-40) **Simulation of azimuthal instability in relativistic electron rings.** Beloshitskij, P.F.; Perel'shtejn, Eh.A.; Shchinov, B.G. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Results of numerical simulation of azimuthal instability in relativistic electron rings in monomode and multimode regimes are given. In monomode regime the evolution of the function of beam distribution at the stage of developed nonliniarity greatly depends on the type of impedance. In the multimode regime at the stage of developed instability a decrease of the excited values takes place:

harmonics, density field energy and consequently, the growth of the energetic spread in the ring slows down.

38209 (JINR—D-9-82-664, pp 66-68) **Experimental study on the electron beam acceleration in the system of radial lines with ferrites.** Zakutin, V.V.; Shenderovich, A.M. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

To investigate the possibility of obtaining the maximum intensity of the accelerating field, the acceleration of nanosecond pulses of the electron beam with the current in the range of hundreds of amper in a single radial line and the system of three binary radial lines with ferrites is investigated. The dependence of growth of particle energy on the front of the supply voltage pulse is investigated. Accelerating voltage for the cell of 80 kW is obtianed which is 4 times more than the supply voltage. The energy growth of 230 kev is obtained in the system of three binary radial lines. The average intensity of the accelerating field is 20 kW/cm.

38210 (JINR—D-9-82-664, pp 128-130) **Formation of a beam with a small emittance from the KUTI intense ion beam.** Kuznetsov, A.B.; Prejzendorf, V.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Results of investigations in the formation of an ion beam with low emittance in a collective accelerator of heavy ions are presented. It is shown that using special magnetooptical elements it is possible to transform an element in such a way that it becomes preaxial and its emittance in Cartesian coordinate decreases considerably. At the first stage of formation a magnet with two coaxial pole pieces inserted one into another between which azimuthal homogeneous radial magnetic field is created is used. The further transformation is done by a magnetic lense with azimuthal field created by frames with current. The possibility of obtaining effective beam emittance of the order of (7-8) π mradxcm is shown.

38211 (JINR—D-9-82-664, pp 164-166) **Slow electromagnetic waves in a cylindrical waveguide with a beam and their application for electron rings acceleration and focusing.** Bogdanova, S.N.; Litvinenko, E.I.; Reshetnikova, K.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Using the example of a cylindrical waveguide completely filled with preliminarily simulated magnetized electron beam the relation of the phase rate of slow waves of the spatial charge with the intensity of electric field and beam current in hydrodynamic approximation is found. To use such waves for transport and acceleration of electron rings the case is investigated when waveguide radius is much more than the beam radius. It is shown that with the approachment of beam current value to the limiting value, the wave phase rate decreases, while the intensity of the field rises. To achieve the phase rate of 0.1 and the amplitude of the field of the order of 35 kW/cm at the ring radius the current of 0.2 kA is required. It is shown that at the selection of the corresponding field phase the acceleration of the electron ring is possible if the current of the preaxial beam is decreased or its energy is increased.

38212 (JINR—D-9-82-664, pp 206-200) **High-current beam induced radiation in the intrinsic field.** Lebedev, A.N.; Martirosyan, G.V. (AN SSSR, Moscow. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

Dispersion properties of high current cylindrically symmetric non-rotating stationary monoenergetic beam of electrons with the self magnetic field are studied. In the approximation of the assigned field the expression is found for coefficient of amplification in submillimeter range of waves, as well as parameters of induced radiation.

38213 (JINR—D-9-82-664, pp 218-220) **Multicomponent fluxes and negative ion production in a magnetic insulation diode.** Agafonov, A.V.; Lebedev, A.N.; Orlov, D.B. (AN SSSR, Makhachkala. Fizicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

The model for the generation of negative ions in a flat diode with magnetic isolation is described. The diode is formed by two parallel conducting planes. It is shown that under real conditions currents of H^- ion fluxes of 20-40 A/cm^2 can be obtained in diode with magnetic isolation. Plasma composed of halogens is most suitable for these purposes. The current of heavy ions becomes one order lower when light ions in plasma are absent.

38214 **(JINR—R-5-82-879) Effect of the third order difference resonance 2νsub(Z)-νsub(X)=1 on the particle motion in cyclic accelerators.** Amirkhanov, I.V.; Zhidkov, E.P.; Zhidkova, I.E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701552.

The third-order resonanCe 2νsUb(z) - πsub(x) = 1 which occurs near the working point of the JINR synchrophasotron is studied. The investigation was performed using the Krylov-Bogolubov averaging method. The first approach of the resonance was analytically investigated. The second one was evaluated with the help of the system for analytical evaluation by the REDUCE-2 computer. The boundedness of amplitUdes on time interval [0, 1/2] has been proved.

38215 **(JINR—R-9-82-652) High-order resonances of electron-ion oscillation (one-dimensional model).** Aleksakhin, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701554.

Density oscillations of uniformly charged electron-ion layers with coincident boundaries are studied in the framework of the linear perturbation theory. The consideration is based on the strict solution of the problem of electrostatic oscillations in the layer of charged particles with uniform density, discovered by F. J. Sacherer. It is found that electron-ion layers are subjected to resonance instability which leads to forming clusters in the phase space. The resonance widths and the instability growth rates are calculated.

38216 **(JINR—R-9-82-925) Magnetic field median plane determination and correction for the JINR phasotron.** Zaplatin, N.L.; Ivashkevich, S.A.; Morozov, N.A.; Shishlyannikov, P.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701555.

The measurement and correction of the magnetic field median plane of the JINR high current phasotron are described. The data on the measurement of the horizontal field components are presented. The mesurement of the difference of the vertical fiel components in two planes at 8 mm distance from the median plane of the magnet gap was used.for the mean radial component of the magnetic field. The Hall effect transducer rigidly fixed on the coordinate system was selected for determining Fourier harmonics of the magnetic field horizonal components. After the iron elements of the magnetic system reassembling the magnetic field median plane deviation from the gap medium plane is not over +-5 mm.

38217 **(JINR—R-9-83-123) Magnetic field shaping for the JINR phasotron (2 stage).** Zaplatin, N.L.; Ivashkevjch, S.A.; Morozov, N.A.; Shishlyannjkov, P.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701556.

The shaping of the magnetic field of the JINR phasotron is described. The purpose of this investigation was to obtain the re-

quired dependence of the average magnetic field on radius and required accuracy for the field low harmonics amplitudes. The shaping of the magnetic field resulted in deviation of 1.5 mT in an average magnetic field and the low harmonics amplitudes were less than 1 mT for all radii. The vertical and radial focusing of charged particles and the phase stability were realised. The data obtained for the trim coils of the magnetic field are presented.

38218 **(KFTI—82-44) Discrete methods for the accelerating structure optimization.** Ovsyannikov, D.A.; Romanyuk, L.P.; Papkovich, V.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701570.

Mathematic methods of optimization of charged particle motion in accelerating structures, particle dynamics in which is described by discrete equations, are suggested. The general technique of directed search of parameters of accelerating structures, providing for obtaining optimum, in certain respect, characteristics of the beam at the accelerator outlet is presented. Results of numeric minimization of the energetic spectrum of the accelerated particle beam with rather low phase scattering are presented.

38219 **(LBL—17805) Considerations regarding the choice of beam parameters and IP configuration for the SSC.** Leemann, C. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 9p. (CONF-831264—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014532.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

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Beams consisting of closely spaced bunches, crossing at a small angle, represent the simplest way to achieve high luminosity with a moderate beam current and an acceptable peak event rate without resorting to the use of dipole magnets at, or very close, to the interaction point (IP). The elements of a procedure to derive beam parameters for this particular configuration form the content of this note.

38220 **(SLAC/AP—27) Skew quad compensation for SPEAR minibeta optics.** Wille, K. (Stanford Linear Accelerator Center, CA (USA)). Jun 1984. Contract AC03-76SF00515. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015180.

With the new minibeta insertion for SPEAR the betatron coupling and the perturbations of beam optics caused by the solenoid field of the MARK III detector can't be compensated by the simple coils used so far. Therefore another scheme with four skew quads arranged in two families has been chosen. Even though this scheme doesn't compensate the effect of the solenoid on the beam completely, the residual emittance coupling is much less than 1% which should be sufficient under all running conditions. The major advantage of this concept is its simplicity.

38221 **(SLAC-CN—172-R1) Linac quadrupole connections.** Stiening, R. (Stanford Linear Accelerator Center, CA (USA)). 12 Jul 1984. Contract AC03-76SF00515. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014694.

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Linac type QC and QCH quadrupoles are mounted on the accelerator with their power connection side facing the injector. The connections are on the top of the magnet. The correct polarity for magnets is shown. The magnetic centers of all magnets are measured. If the magnetic center is above the geometric center, the distance δ y is positive. If the magnetic center is to the right of the geometric center, the distance δ x is positive.

38222 **(SLAC-CN—272) Modification of the code BEAMCORR, and some simulation results of the magnet and achromat misalignments for the SLC South Arc.** Shoaee, H.; Kheifets, S. (Stanford Linear Accelerator Center, CA (USA)). 11 Jul 1984. Contract AC03-76SF00515. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013750.

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An important decision has been made regarding the correction scheme for the arcs leading to the adoption of the so called scheme I. In this scheme the beam position data are collected from single-plane x and y Beam Position Monitors (BPMs), which are placed in the drift spaces adjacent to the downstream D- and F-magnets correspondingly. Similarly, single-plane x and y correctors are used for moving the upstream end of the corresponding magnets. In the present simulation this scheme is used exclusively. The first order calculations performed by means of TRANSPORT appear to be unsatisfactory from the point of view of the beam spotsize at the interaction point (IP). In this note we describe the modification to our program BEAMCORR which employs second order calculations by means of the program TURTLE. We also present the results of the following simulations: (a) study of the effects of two different levels of magnet misalignment on the beam spotsize at IP, and comparison of the results with those obtained by means of the program DINGBAT; (b) study of disjoints between achromats (both the displacement of the adjacent ends and angular discontinuity between achromats).

38223 **(SLAC-CN—275) Temperature rise in iron beam position monitors.** Nelson, W.R.; Jenkins, T.M. (Stanford Linear Accelerator Center, CA (USA)). 24 Jul 1984. Contract AC03-76SF00515. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015185.

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This note presents the results of EGS calculations for the temperature rise in an iron beam position monitor strip in the SLC arcs for a 50 GeV incident electron beam. Temperature rises of about 830°C per pulse are possible for 50μ (Gaussian σ) beams of 5 x 10^{10} electrons per pulse if the angle of incidence is great (i.e., around 30 mradians).

38224 **(SLAC-PUB—3314) Luminosity enhancements at SLAC.** Coward, D.H. (Stanford Linear Accelerator Center, CA (USA)). Apr 1984. Contract AC03-76SF00515. 10p. (CONF-840396—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014337.

From International conference on instrumentation for colliding beam physics; Novosibirsk, USSR (15 Mar 1984).

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Several ideas are discussed that have been proposed to improve the luminosity at the SPEAR and PEP electron-positron storage rings and to insure good luminosity at the SLAC Linear Collider. There have been two proposals studied recently for SPEAR: a Microbeta insertion using Samarium Cobalt permanent magnets, and a Minibeta insertion using conventional quadrupole magnets. The notations Microbeta and minibeta used here are somewhat arbitrary since the front faces of the first quadrupole magnets for both insertions are at nearly the same distance from the interaction point.

38225 **(UCRL—90242) Status of beam transport with the ETA and ATA accelerators.** Struve, K.W.; Caporaso, G.J.; Chong, Y.P.; Clark, J.C.; Fessenden, T.J.; Lauer, E.J.; Prono, D.S.; Weir, J.T.; Chambers, F.W. (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 17p. (CONF-840529—40). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013205.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

Both the Experimental Test Accelerator (ETA) and the Advanced Test Accelerator (ATA) are 10 kA electron induction linacs. The ETA produces a 4.5 MeV, 30 ns pulse, and the ATA a 50 MeV, 70 ns pulse. The ETA has been operational since 1979, having produced over 6 million pulses. Both the beam breakup instability and lower frequency transverse motions of the beam have been suppressed by accelerator cavity damping and with a wire damping zone. These efforts will be summarized. The ATA has become operational within this last year. Full beam current operation has not yet been achieved because of low-frequency transverse motion and centroid drift of the beam. The beam breakup instability has also been observed but does not disrupt the beam. Efforts at finding the source of the drift and low frequency motion, as

well as wire damping of these motions will be reported. 6 references, 6 figures.

38226 **Collective ion acceleration by a reflexing electron beam: Model and scaling.** Mako, F.; Tajima, T. (Naval Research Laboratory, Washington, DC 20375). *Physics of Fluids;* 27: No. 7, 1815-1820(Jul 1984). Contract FG05-80ET53088.

Analytical and numerical calculations are presented for a reflexing electron beam type of collective ion accelerator. These results are then compared to these obtained through experiment. By constraining one free parameter to experimental conditions, the self-similar solution of the ion energy distribution agrees closely with the experimental distribution. Hence the reflexing beam model appears to be a valid model for explaining the experimental data. Simulation shows in addition to the agreement with the experimental ion distribution that synchronization between accelerated ions and electric field is phase unstable. This instability seems to further restrict the maximum ion energy to several times the electron energy.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 43030037390, 38201, 38226, 38357

38227 **(BNL—34300) Normal-incidence monochromator branch line on the FEL-Undulator for experimental studies in the 5 to 30 eV region.** Johnson, P.D.; Stoffel, N.G.; Klaffky, R.; Smith, N.V. (Brookhaven National Lab., Upton, NY (USA); Bell Labs., Murray Hill, NJ (USA)). 1983. Contract AC02-76CH00016. 14p. (CONF-830910—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014379.

From 3. national conference on synchrotron radiation instrumentation; Upton, NY, USA (12 Sep 1983).

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The proposed installation of an experimental beam line to exploit the photon flux from the FEL Undulator on the Brookhaven VUV ring is described. It is shown that under the normal operating conditions of the VUV ring the Undulator should produce an intense flux of photons in a highly collimated beam in the energy range from 5 to 200 eV. It is intended to construct a beam line based on a McPherson 225 monochromator which will allow an experimental program in the range 5 to 30 eV. The optical layout of the beamline is discussed with particular emphasis on the requirements of coupling a highly collimated source to such a monochromator. The experimental program is designed to utilize either the high photon flux with medium resolution or a more modest flux with the potential high resolution to be obtained from the monochromator. Planned experiments include High k-space resolution Angle-resolved photoemission, high resolution gas phase studies and spin resolved photoemission from solid surfaces.

38228 **(BNL—34966) High energy-resolution inelastic x-ray scattering.** Hastings, J.B.; Moncton, D.E.; Fujii. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 15p. (CONF-840264—6). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014565.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

A brief review is presented of various aspects of high energy-resolution inelastic x-ray scattering based on synchrotron sources. We show what kinematical advantages are provided by the photon probe and propose mirror and monochromator designs to achieve an optically efficient beam line for inelastic x-ray scattering.

38229 **(DL/SCI/R—20) Collaborative research in synchrotron radiation. Proceedings of the Joint UK-USSR seminars held at Daresbury Laboratory, November 1982.** West, J.B. (Daresbury Lab. (UK)). 1984. 51p. (CONF-8211147—Exc.). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780531.

From Daresbury study on application of synchrotron radiation to problems in materials science; Daresbury, UK (13 Nov 1982).

Papers presented were entered into the data base separately. (WHK)

38230 **(DOE/SF/00515—T34) SLAC users bulletin No. 97, January-May 1984.** (Stanford Linear Accelerator Center, CA (USA)). 1984. Contract AC03-76SF00515. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014777.

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Operational and Research activities for the period from January through May 1984 are reported in the areas of experimental activity, PEP activity, SPEAR activity, nuclear physics injector, SLC, data analysis group, EPAC actions, and NPAC actions. A long range schedule and a table of approved experiments are included. (GHT)

38231 **(EFI—545(32)-82) Electron channel of the EPI accelerator for experiments on tagged photons.** Bayatyan, G.L.; Vartanyan, G.S.; Gishyan, S.A.; Zapol'skij, N.A.; Kovalenko, V.N.; Knyazyan, S.G.; Margaryan, A.T.; Markar'yan, A.A.; Shakhazizyan, S.R. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701541.

The electron channel of the EPI accelerator for experiments on tagged photons is described. The slow extraction of electrons is carried out using schemes with separated functions consisting of six lenses in six focusing rectilinear intervals. The tract of extracted electrons with an analyzing tagging magnet is described. The basic characteristics of elements used in the channel of extracted electron beam are presented.

38232 **(EFI—598(85)-82) Measurement of the extracted electron beam profile by means of a proportional chamber.** Arakelyan, E.A.; Bayatyan, G.L.; Vartanyan, G.S.; Grigoryan, N.K.; Kechechyan, A.D.; Marikyan, G.G. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701542.

The description is given of a system for charged particles beam profile measurement used for the extracted electron beam monitoring at the Erevan synchrotron. The system is based on a proportional chamber with dimensions of 128x128 mm and 2 mm spacing of signal wires. The coordinate is determined by the inter-wire delay method. The microelectronic cells are used as delay elements. The information is extracted for the amplitude analysis. The load of the system has been as high as $2x10^4$ c^{-1} per wire.

38233 **(FERMILAB/TM—1271) Semi-remote handling of radioactive devices in the Fermilab target stations.** Eartly, D.; Currier, R.; Lindberg, J.; Sobczynski, S.; Stredde, H.; Strickland, W. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1984. Contract AC02-76CH03000. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015326.

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Six additional, isolated, and self-contained target stations are being built as part of the upgrade of the three Fermilab fixed target Experimental Areas. One new system of shielding and semi-remote component handling via a crane is being developed for all of these. The first of these stations is under test. The system is simple and flexible. It successfully provides semi-remote handling of components from within the shielding of the stations.

38234 **(INIS-SU—236, pp 85-88) Peculiarities of using mixed deuterium and tritium ion beams of complicated atomic-molecular composition for fast neutron generation.** Kir'yanov, G.I.; Syromukov, S.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Radiatsionnoj Tekhniki, Moscow (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The neutron yield is calculated depending on deuterium and tritium beam parameters as well as on the target parameters. Cases of target presaturation with hydrogen nuclides and of target stuffing with the ion beam in the process of the system functioning are discussed. It is shown that the neutron yield is approximately three

times more in the case with a pure beam compared to the case with a niked beam.

38235 (INIS-SU—236, pp 94-98) **Experiments on electron beam slow resonance extraction from a storage ring onto an internal target.** Bulyak, E.V.; Efimov, S.V.; Kozin, V.P.; Markov, V.V.; Mocheshnikov, N.I.; Reprintsev, L.V.; Tarasenko, A.S. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Slow vertical extraction of a circulating beam onto an internal target on a third order one-dimensional resonance is experimentally studied on an operating storage ring. The extraction speed dependence on the sextuple lens power and distance from a target to an orbit plane is studied. It is shown that the low current slow extraction pattern up to 50 mA basically corresponds to the existing theoretical notions.

38236 (INIS-SU—236, pp 114-118) **Calculation of characteristics and calibration of a charged particle magnetic analyzer.** Kolmogorova, S.V.; Krechetov, Yu.F.; Saruev, G.A. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

To carry out experiments on meson photoproduction possibilities of a magnetic analyzer with strong focusing are studied. Analyzer calibration was performed using a ^{239}Pu α-source. The measured analyzer space angle was $(3.52+-0.12)x10^{-3}$ sr. The momentum acceptance was +12% -14%. The best horizontal focusing point practically coincided with the calculated output focus value. Dispersion was determined as a ratio of the line peak shift to the momentum variation. The mean dispersion was (4.10+-0.12) mm/%. The analyzer resolution was determined as a ratio of the line width at the half-height to dispersion and the resolution value equal to (3.10+-0.18)% was found. The dependence of resolution on the momentum is given.

38237 (JINR—9-83-115) **10 MeV/nucleon linear ion accelerator.** Beznogikh, Yu.D.; Govorov, A.I.; Zinov'ev, L.P.; Monchinskij, V.A.; Semenyushkin, I.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701563.

A version of modification of a synchrophasotron injection complex in order to increase energy of the injected beam upto 10 MeV/nucleon is considered. It will expand the mass spectrum of nuclei accelerated in the synchrophasotron and essentially increase their intensity. The ability to accelerate protons up to 18 MeV energy is conserved. It should be noted that nominal high energy accelerating fields in resonators of the proposed linear accelerator also permits the ion acceleration with Z/A=0.3. After stripping at the output of the linear accelerator the main composition of the accelerated beam for light elements will have a nuclear component.

38238 (JINR—9-83-311) **U-2g0 cyclotron operational experience and improvement.** Gigal, B.N.; Gul'bekyan, G.G.; Kozlov, S.I.; Oganesyan, R.Ts. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701566.

Brief description of main syste's of the U-200 isochronous 2-m cyclotron put into operation in 1968 is given and its operational characteristics a e presented. The cyclotron is used for conducting investigations in the field of nuclear physics. Ions from deuterium to argon have been accelerated in the cyclotron. Annual time of target irradiation constitutes 2000-4000. The specific features of the cyclotron are: high level of a magnetic field (of about 20 kOe), possibility of acceleration of ions with different mass-to-charge ratio allow correcting winding power, simple and highly-effective beam extraction by the method of charge exchange on a thin target allowing to vary smoothly energy of extracted ions. An experience in the U-200 cyclotron development and operation is used as the basis for designing and choosing basic parameters of the U-200P, U-250, U-400 heavy ion cyclotrons.

38239 (JINR—9-83-416) **Studying the process of heavy on acceleration from laser plasma at the U-200 cyclotron.** Gikal, B.N.; Kolesov, I.V.; Pa yuk, A.S.; Bykovskij, Yu.A.; Gusev, V.P.; Kozyrev, Yu.P.; Peklenkov, V.D.; Uzienko, D.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701569.

The processes of heavy ion captur and acceleration in the U-200 isochronous cyclotron using the laser source on the base of the CO_2-laser is investigated. The C_{12}^{3+} ions from laser plasma, the ion current density for which is an order larger than that for an arc source, have been accelerated for the first time, and the acceleration process of a dense ion bunch with the duration of several microseconds has been investigated. It is found that at pulse intensity of about 1 ma cyclotron operation conditions eliminating breakdown and high voltage decrease at the dees may be realized and ion acceleration with ordinary for the U-200 cyclotron losses may be carried out. A conclusion about favourable prospects of increase of operational vacuum in the cyclotron during operation with laser source and acceleration of multicharged ions is drawn. In this case the losses due to beam stripping decrease. Usage of small amounts of a working substance in the laser source permits acceleration of rare isotopes. Further prospects in development of laser sources for cyclotrons are connected with an increase of laser power and operational frequency and with optimization of ion source design.

38240 (JINR—10-83-382) **Model of a superconducting magnet power supply control system.** Dmitrieva, E.A.; Nikitaev, P.I.; Gaevski, K.; Susova, G.M.; Trachik, K.; Turzo, I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 6p. (In Russian). (CONF-8309239—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701562.

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Power source used for supplying elements of magnetic optics of a superconducting nuclotron injector is described. The power supply control system, with the help of which the problem of complicated current shape generation is solved, is considered. The control system is built up in the CAMAC standard. For interfacing the crate line with the "Elektronika-60" microcomputer, the VKK-608 crate controller is designed. The crate controller is universal device and can be controlled by a duplex register placed at any point of the system (the computer interface card, CAMAC crate etc.).

38241 (JINR—D-2-82-568, pp 21-25) **Cryogenic source of polarized deuteron beams for synchrophasotron.** Belushkina, A.A.; Valevich, A.I.; Gaj, G.I. 1982. (In Russian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780158. (CONF-8205252—).

From Meeting on investigations in the field of relativistic nuclear physics; Dubna, USSR (25 May 1982).

A "Polaris" device for the production of high-energy polarized deuteron beams at the JINR synchrophasotron is described. The device consists of a cryogenic sourse of polarized atoms and Penning cryogenic ioniser. The intensity of a polarized deuterium atom beam is approximately $5x10^{16}$ at/cm^{2}xs. Current of the polarized deuteron beam the ionizer output is 2O0 μA; the polarized deuteron beam current after the spin rotation is approximately 60 μA; the intensity of the polarized deuteron beam at the synchrophasotron output (during the first run) is $1-2x10^9$ part/pulse. The source can operate without the accumulated deuterium sublimation more than three weeks 250 l liquid helium is required for the device precooling. 200 l helium during a week is required for its successive operation. Liquid helium addition into the cryostats is necessary to perform in 3-4 days.

38242 (JINR—D-9-82-664, pp 23-26) **Gasodynamic, effusion and plasma atomic sources for ion loading of electron rings at the heavy ion electron-ring accelerator.** Novikov, V.G.; Sarantsev, V.P.; Ter-Martirosyan, Z.A.; Shestakov, B.A. 1982. (In Russian). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780156. (CONF-8205251—).

From Conference on collective methods acceleration problems; Dubna, USSR (18 May 1982).

To load the electron rings with ions, gas dynamic, effusion and plasma sources of atoms are developed. According to the sort of generated atomic fluxes these sources cover all the Periodic system. In the design gas dynamic source (GDS) is intended for operation with the frequency up to 10 Hz. The main element of GDS is a fast-response electrodynamic value the tightening element of which opens and closes the system of 6 apertures of the nozzle apparatus at the end of the tube forechamber filled with gas taken for injection. The flux rate at the gas temperature of 293 K is $1x10^5$ cm/s for hydrogen, $7x10^4$ cm/s for nitrogen and $3x10^4$ cm/s for xenon. In effusion sourse the working medium (Pb, In, Zn, Cd, Mn, Hg) is heated up to the corresponding temperature, then it is partially transmitted in the vapour state and the atoms are injected in the electron ring through the nozzle. In the test of the sourse lead atom fluxes with the duration from 300 μs and more at the flux rate of $3x10^4$ cm/s are obtained. The plasma sourse is a coaxial plasma gun that operates in the regime of vacuum charge with forced ignition. For lead the integral particle flux for one pulse is 10^{11} cm^{-2} at the duration of the flux of 50 μs and the flux rate of $(1-3)x10^5$ cm/s.

38243 **(JINR—R-9-83-13) Injection system of the collective accelerator model.** Zhabitskij, V.M.; Ivanov, I.N.; Kaminskij, A.K.; Sergeev, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701557.

Multiturn-injection of electron beam into adhezator, while being obtained electron rings with the 10^{12}-10^{13} electron number are studied. Injection is performed by the linear induction accelerator with the E=1.5 MeV electron energy, I=100-150 A current, 200 ns duration. The electron extraction out of the input device is accomplished by pulse magnetic field. For obtaining the pulse magnetic field a current generator has been designed. It is supplied by the inductive loading $L=1.5x10^{-6}$ H, longitudinal current pulse - I=6 kA, pulse-rise time - 70 ns, pulse-fall time - 100 ns. To measure amplitude and radius of injected and captured beam magnetoinduction sensors have been worked out. The system could be applied to the electron beam formation with the particle number $(2-5)x10^{12}$ electrons.

38244 **(JINR—R-9-83-54) Specific features of beam captu e in the injection system with fast-varying magnetic field.** Zhabitskij, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1983. 2Op. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701560.

The method of calculating the particle capture coefficient for the beam injection systems ith a fast-varying magnetic field in adhezator of a collective accelerator is suggested. On the base of the expressions obtained, the effect of the injected beam parameter and the magnetic field in an adhezator on the conditions of the injection nozzle tracing is analyzed. The conditions under which all particles of the beam are captured into an electron ring at the simultaneously minimum value of the beam removal velocity from the injection nozzle an betatron oscillation amplitude near the equilibrium orbitare found. The peculiarities of the beam capture with the given particle current pulse duration during which the conditions of the injection nozzle tracing change are determined.

38245 **(JINR—R-13-83-184) Spark gaps for a voltage pulse generator.** Aksinenko, V.D.; Volodin, V.L.; Dement'ev, E.A.; Kaminskij, N.I.; Matyushin, A.T.; Matyushin, V.T.; Matyushevskij, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 2p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701551.

An arrangement of gas spark gaps for commutating capacitors of high-generators made as sections which are connected in a tube by general studs is described. The spark gaps operate in nitrogen under the 0.3-0.35 MPa pressure, the generator has 10 sections a step charging voltage is 50 kV. The generator of two-meter streamer chamber with such spark gaps perform 160 thousand operation without considerable changes in its parameters.

38246 **(JINR—R-16-83-341) Angular and energy distributions of fluence and dose equivalent of neutrons produced in a thick carbon target bombarded with 4.2 MeV/nucleon ^{48}Ti ions.** Tsovbun, V.I.; Cherevatenka, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of Radiation Safety). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701539.

Fluence and dose energy distributions of neutrons have been unfolded using readings of a thermal neutron detector places inside polyethylene spheres and theshold carbon detector. Neutrons have been produced in a graphite target bombarded by 4.2 MeV/nucleon ^{48}Ti ions. Neutron yield has been estimated as $(1.0+-0.3)x10^{-4}$ neutrion. Neutrons with energies more than 20 MeV emitted at 0 deg comprise (0.2 0.1)% from the total number of neutrons emitted in this direction Angular distributions of dose equivalents are compared with those obtained by approximation.

38247 **(KFTI—83-13) Experimental study on the angular and polarization characteristics of relativistic electron beam synchrotron radiation.** Guk, I.S.; Gladkikh, P.I. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. 29p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701572.

The results of experimental study on angular distributions of linear components of synchrotron radiation (SR) polarization in the range of varying the ratio of the observed wave length to the critical wave length from 0.4 to 2 are presented. The effect of electron beam parameters on angular distribution of π-component is experimentally and theoretically investigated. A model accounting for the effect of dimensions, divergence of an electron beam and value of phase shear between SR σ and π-components on SR angular distriubution is suggested. Agreement of experimental and calculation data is obtained within the limit of measurement accuracy (2.5%). One of the reasons for appearance of SR angular distribution asymmetry is experimentally disclosed: change of optical characteristics of windows (possibility under the effect of bremsstrahlung). The experimental angular distributions with the calculated ones are compared according to the theory with account of electron betatron oscillations, good agreement of the theory and the experiment is obtained.

38248 (LA—9933-C-Vol.2, pp 833-841) **Operating experience with AGS separated beams lines.** Lazarus, D. (Brookhaven National Lab., Upton, NY). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The AGS kaon beam lines are briefly described. A floor plan is shown and the beam optics are described. Tables show operating characteristics and experiments operating from 1970 to 1983.

38249 (LA—9933-C-Vol.2, pp 842-848) **Low-energy beam lines at CERN.** Peng, J.C. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The low-momentum separated kaon beam line (K-26) was constructed at CERN with the shortest possible length for hypernuclear experiments involving Λ and Σ hypernuclei. This line was designed with suitable attention to the reduction of experimental background. The salient design features are described.

38250 (LA—9933-C-Vol.2, pp 849-858) **Separated kaon beams at KEK.** Masaike, A. (National Lab. for High-Energy Physics, Tsukuba, Japan). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The synchrotron at the National Laboratory for High Energy physics (KEK), Japan, provides two separated beam lines for research. These are the K-2 beam line, operating between 1 and 2 GeV/c, and the K-3 line, operating between 0.5 and 0.8 GeV/c. The latter line exists in two versions, K3-S and K3-L, the former optimized for low-momentum performance. The parameters for each of these lines are discussed and proposed improvements described.

38251 (LA—9933-C-Vol.2, pp 859-862) **Kaon beam line designs.** Lobb, D.E. (Univ. of Victoria, British Columbia). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Past and present low-momentum ($\approx$0.5-GeV/c) beam lines have had π/κ ratios $>$10:1. With the higher fluxes expected at future kaon factories, it is important to reduce this ratio. Since it will no longer be necessary to design beam lines for maximum flux (i.e., as short as possible), additional beam optical criteria may be introduced to reduce contamination.

38252 (LA—9933-C-Vol.2, pp 863-867) **Design considerations for a kaon beam line.** Enge, H.A. (Massachusetts Inst. of Tech., Cambridge). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

A formula is developed for designing a beam line with optimum kaon flux, given the beam size at the production target, the π-to-K separation factor, and the maximum voltage of the electrostatic deflector.

38253 (LA—9933-C-Vol.2, pp 868-874) **Plans for a separated K beam at the AGS.** Lazarus, D.M. (Brookhaven National Lab., Upton, NY). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

There has been interest expressed in the construction of a beam of 10^6 kaons between 1.4 and 1.8 GeV/c for the hypernuclear program at Brookhaven. The beam would be useful for S = -2 dibaryon searches, for possible cascade hypernuclear production, and perhaps for exotic cascade atoms for x-ray studies. There are several approaches in general for separated K-beam designs: "conventional" electrostatic separation, separation by differential energy loss between K's and π's, multiplate separator design, and radiofrequency-separated beams. These are briefly discussed.

38254 (LA—9933-C-Vol.2, pp 960-961) **Perspective from Thiessen.** Thiessen, H.A. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Beam line requirements for LAMPF II are summarized. Polarized beams, pulsed muon beams, pion beams, kaon beams and antiproton beams are briefly discussed.

38255 (LA—9933-C-Vol.2, pp 962-964) **K^0 beam lines.** Lee, D.M. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The parallel session on K^0 beams, chaired by Mike Schmidt of Yale, met on Friday, July 22. The purpose of the working group was to develop a set of criteria, requirements, and specifications for a K^0 beamline that could be used in designing a first class K^0 beamline at LAMPF II. Requirements for the kaon neutral long-lived beam line are summarized.

38256 (LA—9933-C-Vol.2, pp 965-968) **High-momentum, charged kaon and pion facilities at LAMPF II.** Fitzgerald, D.H. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Requirements for high-momentum K and π beam facilities were discussed primarily in terms of two broad, distinctly different classes of experiments. These are: in-flight, charged K-decay; K-nucleon and π-nucleon scattering and reactions. The facility requirements for these two types of experiments, while not necessarily incompatible, are based on quite different considerations. Therefore, the requirements which emerged during the workshop are presented separately for each case.

38257 (LA—9933-C-Vol.2, pp 969-976) **LAMPF II muon facility requirements.** Heffner, R.H. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The development of a LAMPF II accelerator would provide very high-intensity stopping muon beams for experiments in nuclear, particle, and solid-state physics. The dc beam structure would provide a factor of 10 increase in counting rate for experiments currently limited by the 10% macroscopic duty available at LAMPF. Because of the high proton energy at LAMPF II, the μ^- flux would be at least 25-50 times that at LAMPF now. Considerable work has already gone into developing both the scientific and technical bases for muon facilities at LAMPF II. Some general points which came out of the current workshop are discussed.

38258 (LA—9933-C-Vol.2, pp 977-979) **Hadronic atoms - facility requirements.** Hoehn, M.V. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The facility requirements for hadronic atom experiments are discussed. K^- and Σ^- atoms, Ξ^- atoms and a Gatchina target are considered.

38259 (LA—9933-C-Vol.2, pp 980-985) **Nuclear chemistry facilities at LAMPF II.** Dropesky, B.J. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The nuclear chemistry community intends to contribute to the nuclear science output from LAMPF II in two broad areas. These are: studies of new nuclei far from -stability and studies of reactions in complex nuclei induced by high-energy pions, kaons, and antiprotons. Beam requirements in these areas are summarized.

38260 (LA—9933-C-Vol.2, pp 986-988) **Nucleon and antinucleon facilities at LAMPF II.** Van Dyck, O.; McNaughton, M.W. Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Requirements for nuceon and antinucleon facilities at LAMPF II are summarized. Design of the antiproton beam line is discussed and its location is considered.

38261 **(LA—10103-MS) Long-range-planning committee for LAMPF computing needs report.** Hoehn, M.V.; Amann, J.F.; Butler, H.S.; Dawson, W.K.; Hoffman, E.W.; Hofteizer, J.; Kaletka, M.O.; Kinnison, W.W.; Kozlowski, T.; McNaughton, M. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015071.

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The recommendations of a study, conducted in October and November, 1983, of the requiremnets for computer support of the experimental program in medium energy physics at the Los Alamos Meson Physics Facility are presented.

38262 (LA—10118-SR) Accelerator technology program. Status report, July-December 1982. Jameson, R.A. (comp.). (Los Alamos National Lab., NM (USA)). May 1984. Contract W-7405-ENG-36. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015052.

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Major projects of the Los Alamos National Laboratory's Accelerator Technology Division are discussed, covering activities that occurred during the last six months of calendar 1982. The first sections report highlights in beam dynamics, accelerator inertial fusion, radio-frequency structure development, the racetrack microtron, CERN high-energy physics experiment NA-12, and high-flux radiographic linac study. Next we report on selected proton Storage Ring activities that have made significant progress during this reporting period, followed by an update on the free electron laser. The Fusion Materials Irradiation Test Facility work is discussed next, then progress on the klystron development project and on the gyrocon project. The activities of the newly formed Theory and Simulation Group are outlined. The last section covers activities concerning the accelerator test stand for the neutral particle beam program.

38263 (LA-UR—84-1921) Development of a 3 tesla - 10 Hz pulsed magnet-modulator system. Krausse, G.J.; Butterfield, K.B. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-8406137—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013907.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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In order to support the experimental work done at the Los Alamos Meson Physics Facility new instrumentation and data collection systems of advanced design are developed on a regular basis. Within the instrumentation system for an experiment at LAMPF, The Photo-Excitation of the H^- Ion Resonances, there exists a need for a pulsed air-core electromagnet and modulator system. The magnet must be capable of producing a field strength of 0 to 3T in a volume of 3.5 cm^3. In addition it must be radiation resistant, have a uniform field, operate in a high vacuum with little or no outgassing, and the physical layout of the magnet must provide minimal azimuthal obstruction to both the ion and laser beams. The modulator must be capable of producing up to a 15KA pulse with duration of two μs at a maximum repetition rate of 10 Hz. Modulator layout must be extremely reliable so that data collection time is not lost during the experiment. This paper describes in detail the development of the system.

38264 (LBL—4235) Large-field medical beam at the 184-Inch Synchrocyclotron. Crowe, K.; Kanstein, L.; Lyman, J.; Yeater, F. (Lawrence Berkeley Lab., CA (USA)). Aug 1975. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015339.

The 184-Inch Synchrocyclotron at the Lawrence Laboratory in Berkeley has, for many years, provided a highly reliable 930-MeV helium-ion beam of relatively high intensity for pituitary irradiation and treatment of lung lesions, etc. A plan view of the medical cave area is shown. For irradiations, a typical beam-spot size of ~ 5 cm with an intensity on the order of 2000 rads/min has been commonly available. With the recent advent of a new method of programming the Dee voltage, dose-rates have been increased to slightly more than 4000 rads/min. In order to enlarge upon the possible therapeutic, diagnostic, and radiobiological research capabilities of the 184-Inch Synchrocyclotron, we have recently developed a large-area helium-ion beam of approx. 30-cm dia with a uniform intensity of about 165 rads/min +- 2% over 86% of the diameter.

38265 (LBL—17086) Electron cyclotron resonance (ECR) ion sources. Jongen, Y. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 21p. (CONF-8404143—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014587.

From 10. international conference on cyclotrons and their applications; East Lansing, MI, USA (30 Apr 1984).

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Starting with the pioneering work of R. Geller and his group in Grenoble (France), at least 14 ECR sources have been built and tested during the last five years. Most of those sources have been extremely successful, providing intense, stable and reliable beams of highly charged ions for cyclotron injection or atomic physics research. However, some of the operational features of those sources disagreed with commonly accepted theories on ECR source operation. To explain the observed behavior of actual sources, it was found necessary to refine some of the crude ideas we had about ECR sources. Some of those new propositions are explained, and used to make some extrapolations on the possible future developments in ECR sources.

38266 (LBL—17685) Heavy ion upgrade of the Bevatron local injector. Staples, J.; Gough, R.; Abbott, S.; Dwinell, R.; Halliwell, J.; Howard, D.; Richter, R.; Stover, G.; Tanabe, J.; Zajec, E. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 4p. (CONF-840529—41). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013239.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

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A new heavy ion injector system for the Bevatron, consisting of a PIG ion source, an RFQ linac, and two Alvarez linacs, is nearing completion. It will make available to the Bevatron a source of ions up to mass 40 independent of the SuperHILAC, enhancing the operational flexibility of the Bevalac complex. The RFQ accelerator, made operational in mid 1983, accelerates ions with $q/A \geq 0.14$ to 200 keV/n. The RFQ is followed by a new 200 MHz Alvarez linac operating in the $2\beta\lambda$ mode which further accelerates the ions to 800 keV/n. This linac is followed by a foil stripper and a portion of the old injector linac, rebuilt to accelerate beams with $q/A \geq 0.35$ to 5 MeV/n in the $2\beta\lambda$ mode. Details are given of the configuration, equipment modifications, and project status.

38267 (LBL—17829) Relativistic radioactive heavy ion beams at the Bevalac. Alonso, J.; Krebs, G. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 13p. (CONF-8404154—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013396.

From Workshop on prospects for research with radioactive beams from heavy-ion accelerators; Washington, DC, USA (26 Apr 1984).

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The Bevalac has been demonstrated to be an efficient source of radioactive beams of good quality, and is attracting a growing body of users of this capability. Immediately on the table are an increasing demand by biomedical experimenters, leading up to eventual clinical use; and two most interesting nuclear science experiments. We are anticipating a substantial increase in interest and demand in coming years, and are planning beam line improvements to enhance transmission and purification efficiencies. 8 references, 3 figures.

38268 (LBL—17935) Prospects for research with radioactive beams and targets. Nitschke, J.M. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 32p. (CONF-8406149—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014609.

From TRIUMF-ISOL workshop; Montreal, Canada (13 Jun 1984).

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Research with heavy ion (HI) beams has become a major field of physics. Nuclei of all naturally occuring elements and isotopes can be accelerated to energies as high as 2 GeV/A with even higher energies expected in the future. With the advent of relativistic heavy ion accelerators and the development of high intensity

on-line isotope separators it has now become possible to explore a new dimension in nuclear physics based on the production and application of radioactive ion beams (RIB). More than 1400 unstable nuclei with half lives of more than 1 μs are known and could potentially serve as projectiles in RIB experiments. The purpose of this paper is firstly to point out that there are now several promising possibilities to obtain RIB's of acceptable intensity and that secondly a large variety of scientific questions can be addressed should such beams become routinely available. The discussion of the production of RIB's is divided into methods where the radioactive species are stopped and reaccelerated, and methods where the RIB emerges as a secondary beam from a suitable nuclear reation. A third section is devoted to the far reaching experimental possibilities related to accumulator and storage rings. The chapters on research will cover the application of RIB's to the synthesis of exotic nuclei, astrophysics, reaction mechanisms, nuclear structure, atomic- and solid-state physics, bio-medicine, and physics related to the special characteristics of storage rings.

38269 (SAND—84-1267C) In-line beam current monitor. Frost, C.A.; Ekdahl, C.A. Jr.; Crist, C.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 9p. (CONF-8406133—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014054.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

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A new type of beam current monitor has been developed which allows the measurement of the electron beam current in a gas neutralized transport line or at an injection point to a propagation cell. Subnanosecond response is obtained by using a low inductance cavity type current viewing inductor (CVL). In order to measure the beam current in a gas environment, the plasma return current must be blocked. In the new design this is accomplished by solid insulation rather than by a vacuum section. This approach minimizes the beam perturbation due to space charge forces and inductive fields and does not require a separate vacuum section.

38270 (SLAC-CN—273) SLC nomenclature for beamline components. Paterson, J.; Silva, J. (Stanford Linear Accelerator Center, CA (USA)). 12 Jul 1984. Contract AC03-76SF00515. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014776.

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The purpose of this report is to document the SLC nomenclature conventions for beamline components. Included are recent enhancements which should lead to a more consistant usage of the "unit number" part of beamline device names. The attached pages are divided into three sections. The first section is a brief summary for the general user. The second section is a more amplified description for those who need more detailed interpretations of device names. The third section contains a few notes for those who must generate device names for new components.

38271 (SLAC-CN—274) North and South Damping Ring nomenclature. Linebarger, W.; Silva, J. (Stanford Linear Accelerator Center, CA (USA)). 12 Jul 1984. Contract AC03-76SF00515. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014775.

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This summary describes the new nomenclature for the beamline components of the Damping Rings Region.

38272 (TRI-PP—84-37) Microprocessor-based radiation monitoring system. Chan, R.; Drozdoff, J.; Moritz, L.; Wait, G. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). May 1984. 4p. (CONF-840512—16). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84901473.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

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At TRIUMF intense beams of 500 MeV protons are used to produce secondary beams of mesons for nuclear physics research. The size and nature of the facility are such that about seventy active monitors of various types are deployed at the site and its boundary to measure accelerator beam spills, air activity, residual activity and neutron radiation levels. In order to process and display the monitor readings a monitoring system has been developed which will accept inputs from a variety of detectors. Two microprocessors are used in a CAMAC based data acquisition and display system. One of the microprocessors handles the display of radiation levels together with warning, trip levels and alarms on a colour CRT monitor while the second micro-processor performs the warning and trip logic and passes appropriate flags to the accelerator interlock system. The programs reside in erasable programmable read-only memory (EPROM) to provide protection against arbitrary changes. The system may be interrogated via a keyboard terminal for diagnostic and calibration purposes and there is a provision to defeat the trip function of individual detectors but such defeats are then displayed on the CRT monitor. All information on radiation levels may be accessed by an independent data logging system allowing extensive records to be kept on magnetic tape for periodic analysis. This system is compact, has high reliability and can readily be tailored to site specific needs.

38273 (TRI-PP—84-42) Optically pumped polarized H^- source at TRIUMF. Levy, C.D.P.; McDonald, M.; Schmor, P.W.; Yao, S.Z. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). May 1984. 3p. (CONF-8405193—30). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84901472.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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An optically pumped ion source capable of producing more than 10 μA continuous polarized H^- suitable for injection into the cyclotron is being constructed. Preliminary measurements of sodium target polarization are reported. Broadband laser pumping is shown to be effective, and increases in polarization with magnetic field and with bi-directional pumping are observed and explained.

38274 Pulsed Cs beam development for the BNL polarised H^- source. Alessi, J.G. (Brookhaven National Lab., Upton, NY). *Vacuum;* **34**: No. 1-2, 7-10(Jan-Feb 1984). (CONF-830348—).

From 3. international conference on low energy ion beams; Loughborough, UK (28 Mar 1983).

A pulsed Cs^+ beam has been developed for use on a polarized H^- source. Caesium ion production is by surface ionization using a porous tungsten ionizer. While satisfactory current pulses (5-10 mA >approx. 0.5 ms) can be obtained, the pulse shapes are a sensitive function of the ionizer temperature and Cs surface coverage. The beam optical requirements are stringent, and the optics have been studied experimentally for both Cs^+ and Cs^0 beams. Computer calculations are in good agreement with the observed results. The present source has delivered 2.6 mA of Cs^+ through the interaction region of the polarized ion source, and as much as 2.0 particles mA of Cs^0. A new source is being built which is designed to give 15 mA through the interaction region.

38275 Characteristics of the WNR - a pulsed spallation neutron source. Russell, G.J.; Lisowski, P.W.; Howe, S.D.; King, N.S.P.; Meier, M.M. (Los Alamos National Lab., NM (USA)). pp 831-835 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

The Weapons Neutron Research facility (WNR) is a pulsed spallation neutron source in operation at the Los Alamos National Laboratory. The WNR uses part of the 800-MeV proton beam from the Clinton P. Anderson Meson Physics Facility accelerator. By choosing different target and moderator configurations and varying the proton pulse structure, the WNR can provide a white neutron source spanning the energy range from a few meV to 800 MeV. The neutron spectrum from a bare target has been measured and is compared with predictions using an Intranuclear Cascade

model coupled to a Monte Carlo transport code. Calculations and measurements of the neutronics of WNR target-moderator assemblies are presented.

4304 Storage Rings

REFER ALSO TO CITATION(S) 43040038235

38276 (CERN—83-10) Design study of an Antiproton Collector for the Antiproton Accumulator (ACOL). Wilson, E.J.N. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Oct 1983. 66p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84701574.

The Report gives a full description of an Antiproton Collector Ring which, placed around the existing Antiproton Accumulator at CERN, would enhance the antiproton flux available to both the SPS and LEAR by a factor of ten. The new ring and the focusing devices which precede it are designed to accept a much larger fraction of the antiproton production cone from the target. Each pulse of particles will be pre-cooled before being fed to the Antiproton Accumulator, where improved stochastic cooling systems will build up the stack. A full list of parameters is included.

38277 (INIS-SU—236, pp 99-104) Experimental study on the low-frequency oscillations in electron storage ring. Bulyak, E.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Low-frequency transverse oscillations are observed on an electron storage ring. To find out the origin of discrete lines in the low-frequency transverse oscillation spectrum experiments with helium and hydrogen leak-in into a chamber were conducted. The experimental dependences of spectra and low-frequency oscillation envelopes on circulating beam energy and current, as well as on the residual gas composition in the vacuum chamber are given. It is shown that self-excitation of these oscillations is explained by positive ions on the storage ring orbit. Stabilization of the transverse beam instability is provided by ejection of a relatively small part of the ion skeleton confined by the beam onto the chamber wall; collective ion oscillations in the formed potential pit restrict instability development. The amplitude of transverse shifts of the system charge centre attains the maximum at 120-180 mA currents.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 44010037354, 37550, 37632, 38095, 38181, 38232, 38272, 38412, 38491, 38539, 38542, 38543, 38607, 38683, 38810, 38812, 38901, 38976

38278 (AERE-G—2865) Evaluation of the procedures in BR 3014 for the assessment of Argon-41 activity in air. Leake, J.W. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Nov 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702558.

This report discusses conflicting measurements which have been made at RNC Greenwich using a 92 cc Argon-41 collection chamber in the detecting assembly MK 5NHA with the counter scaler MK 4NCA. It is concluded that the original calibration is not in serious error but it is recommended that the calibration factor should be increased by 27% over that given in BR 3014.

38279 (AERE-M—3320) Processing data from the Scaler/Timer type 6255. Pattni, V.; Stevens, M.P. (UKAEA Atomic Energy Research Establishment, Harwell. Instrumentation and Applied Physics Div.). Oct 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702573.

The Scaler/Timer type 95/6255-1 is now extensively used for nucleonic counting applications since, in conjunction with other units in the Harwell 6000 Laboratory Series, systems can easily be assembled to meet a wide range of counting requirements. The 6255 is microprocessor-based and contains comprehensive counting and timing facilities (eg 2 scalers, 2 timers, 4 ratemeters, multiple cycle operation, control of other 6255's and RS232C output) and was intended for counting, printing and logging operations; the unit does not, therefore contain facilities for processing data. However, in some applications processing of the data accumulated in the 6255 is needed, for example, for removal of background, for statistical tests etc, and the design of the 6255 enables this to be carried out with a low-cost microcomputer. This report illustrates how this can be done, using the Commodore VIC computer as an example.

38280 (CERN—83-03, pp 229-236) Triggering and filtering in collider experiments. Notz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

We discuss rates for events and backgrund in anti pp and e^+e^- storage rings. Electronic systems recognizing tracks within a few microseconds are presented. These systems work either in parallel or sequential.

38281 (DOE/ER/03130—12) Concept for a magnetic monopole detector using liquid scintillator. Bantly, J.W. (Brown Univ., Providence, RI (USA). Dept. of Physics). Jun 1983. Contract AC02-76ER03130. 77p. (COO—3130TC-12). NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014108.

Portions are illegible in microfiche products; Thesis.

This paper is a description of a new concept for a magnetic monopole detector and a laboratory report of experimental results from a realized version of the concept. There have been no previous tests using this concept although a good number of searches for monopoles have been carried out in the past. Several of these searches are similar to the one in this paper and will be reviewed therein. All of the work for this paper, including all testing and experimentation, was done at Brown University in a lab operated by the High Energy Group here. The particle sources for the experiment were random cosmic rays and the Big Bang (for relic magnetic monopoles). The goal of the experiment is to search for relic magnetic monopoles, or, if none are found, to at least set a flux limit on them. All the work was conducted between December 1982 and June 1983 as a Senior Thesis independent research project. The work centered around testing the equipment and constructing a proper triggering mechanism and, therefore, does not emphasize the theoretical aspects. The theory behind magnetic monopoles from 1896 to present and past experimental searches are summarized.

38282 (DOE/ER/40035—T1) Fine grained hodoscopes based on scintillating optical fibers. Final technical report, June 1, 1983-May 31, 1984. Borenstein, S.R. (York Coll., Jamaica, NY (USA)). 31 May 1984. Contract AC02-81ER40035. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014849.

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This is the final technical report on a project which undertook to develp and test scintillating optical fibers for use in a fine grained hodoscope for experiments in High Energy Physics. After a brief discussion of the need for such a device in experiments in high rate environments, a description is given of the process of drawing and cladding plastic scintillator to form scintillating optical fibers. This is followed by a description of the test procedures used to evaluate the resultant fibers both in the laboratory and at the accelerator. A discussion of three possible readout schemes then follows. These are individual photomultiplier tubes, avalanche photodiodes and microchannel plates with segmented anodes. The results of this study are then presented. The present status of the project is then summarized, in which it is pointed out that significant improvement in useful fiber length has been achieved as a result of this development program. The difficulty of quality control in fiber production remains a serious limitation, and a satisfactory readout

scheme with good optical coupling between many hodoscope elements and photodetectors has yet to be achieved.

38283 **(DOE/EV/10673—T4) Neutron detection using superheated drops. Technical report No. 1 covering the period 1 May 1981-30 June 1984.** Apfel, R.E. (Yale Univ., New Haven, CT (USA)). 1 Jul 1984. Contract AC02-81EV10673. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014632.

The goal of this research is to determine whether neutron detectors based on superheated drops not only have the characteristics desirable for neutron dosimetry (sensitivity and energy response, etc.) but also have the practical attributes (stability and ease of handling) which warrant later commercial development. The results of our research since that time have validated the concept of superheated drops for neutron detection, and have addressed many of the theoretical and practical aspects of developing neutron detectors based on superheated drops.

38284 **(EFI—553(40)-82) Screening of shower particle tracks in track detectors.** Aleksanyan, A.S.; Babayan, G.E.; Megrabyan, G.K.; Oganesyan, Eh.M.; Pikhtelev, R.N. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701609.

The results of the calculations of particle track screening coefficient in electromagnetic cascade during processing the optical information from track detectors by the Monte Carlo method are presented. It is shown that at high energies the corrections for the number of particles in the cascade curve may reach more than 100%. The conclusion is made that the calculational results are in good agreement with experimental data obtained by a spark spectrometer at primary electron energies of 0.5-4 GeV.

38285 **(EGG—1183-414) Radiometric data reduction system for photographic film.** (EG and G Idaho, Inc., Idaho Falls (USA)). 29 Sep 1967. Contract AC08-76NV01183. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014780.

This report presents a brief outline of the photometric data reduction system used to obtain source radiance and power information from photographic records. Special procedures and inputs used in the reduction of Dominic high-altitude data are included in this document. This report is intended as a reference manual for the user of the data reduction system.

38286 **(EGG—1183-446) Radiometric analysis of photographic data by the effective exposure method.** Constantine, B.J. (EG and G, Inc., Boston, MA (USA). Eastern Science and Technology Div.). Apr 1972. Contract AC08-76NV01183. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014912.

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The effective exposure method provides for radiometric analysis of photographic data. A three-dimensional model, where density is a function of energy and wavelength, is postulated to represent the film response function. Calibration exposures serve to eliminate the other factors which affect image density. The effective exposure causing an image can be determined by comparing the image density with that of a calibration exposure. If the relative spectral distribution of the source is known, irradiance and/or radiance can be unfolded from the effective exposure expression.

38287 **(EGG-PBS—6669) Radiation shielding calculations for the ROSA-IV gamma-ray densitometer.** Grimesey, R.A.; Tomberlin, T.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1984. Contract AC07-76ID01570. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015173.

The United States Nuclear Regulatory Commission (NRC) is providing two three-beam gamma-ray densitometers for the ROSA-IV (Rig of Safety Assessment) Facility in Japan. The ROSA-IV Facility is a non-nuclear blowdown facility designed to simulate a pressurized water reactor. The densitometers analyzed in this report will be installed on horizontal sections of the hot leg piping of the facility. Each densitometer includes a 0.5 Ci, Cs-137 source obtained in a tungsten cask. Normally the source will be located in a stored position in the cask which will limit the radiation level to 0.2 mrem/hour at the surface. When the densitometer is to be operated, an air cylinder will be used to move the source to an operating position. The radiation level in the operating position is limited to 10.3 mrem/hour at the surface of the installed instrument. Each densitometer includes a spring to return the source to its stored position if there is a failure in the air supply for the actuating cylinder. The equations and parameters used in the radiation shielding calculations are discussed. The actual calculations and parameters used for each dose point are outlined by labeled dose point.

38288 (INIS-mf—7782, pp 193-197) **Standard spectrometric conversion electrons sources.** Andreev, Yu.A.; Aristov, E.A.; Bazhenov, B.A.; Zhdanova, N.F.; Mescheryakov, V.G.; Stepanov, Eh.K.; Khlebnikov, V.P. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Nomenclature has been given of standard sources and solutions which had been developed during last years and are produced nowdays. One of the last developments are standard spectrometric sources of conversion electrons, which are intended for calibration of scintillation and solid-state β-spectrometers according to the energy and efficiency of registration as well as for measurement of their main parameters and energy resolution, the form of equipment line, instability and so on. In the paper, design and parameters of sources have been described as well as methods of their certification. Standard spectrometric sources are emitting monoenergetic electrons of internal conversion in the energy range of 84-624 keV. Certification of cources is done according to the energy of electrons; proper width of an electron line on the half of heigth; number of electrons of given energy being emitted in the set solid angle (sources come complete with collimators) and according to their activity.

38289 (INIS-mf—7782, pp 230-232) **Application of thermodeposited electron-captured radioactive nuclides radiation sources for measurement of photone flow with energy of 5-100 Kev.** Konstantinov, A.A.; Sazonova, T.E.; Sehpman, S.V. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

An experimental method of determination of efficiency of scintillation detectors for measuring beams of protons of low energy from 5 to 100 keV. has been described in the paper. To calibrate detectors specially fabricated radiation sources made of electron captured nuclides (^{51}Cr, ^{55}Fe, ^{109}Cd) are used. These radiation sources have been fabricated by the method of thermal spraying in vacuume of proper radioactive salt which has high specific activity. Such sources have low self-absorption of radiation and their photone radiation is isotropic which permits to come from measurements in the angle of 2π steradian to measurements in a small solid angle. Photone beam in the angle of 2π steradian was measured with the error not more than +-1% by means of proportional counters or by the method of coincidence. Then, sources were placed in an installation with a small solid angle and calibration of scintillation detectors was done. Error of determination of scintillation detectors efficiency is about 2% (for confidence level of 0.95%). Error in determination of solid angle equals about +-0.5%.

38290 (INIS-mf—7782, pp 171-179) **Principle of equivalent circuit for standardization of complex emitters with conversion electrons of low energy by method of effectivity extrapolation.** Frigorescu, L. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

Advantages have been stated in the paper of application of the equivalent scheme of decay of radionuclides with complicated decay scheme and emitting low energy conversion electrons. In the

most cases it is possible to use the effectivity extrapolation method in the linear variant. Application of the equivalent scheme principle is illustrated by standardization of ^{57}Co and ^{133}Ba.

38291 (INIS-mf—7782, pp 220-224) **Methods and instruments for absolute measurements of specific activity of nuclides.** Garapov, Eh.F.; Gryaznov, A.N.; Pyzhova, G.M.; Sinitsyn, O.V. 1979. (In Russian). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83780837. (CONF-7905228—).

From International symposium on methods of production and measurement of standard sources and solutions; Marianske Lazne, Czechoslovakia (15 May 1979).

The paper gives a description of some methods and instruments for measuring specific activity of nuclides. An installation with 4π-proportional counter is used for measurement of α- and β-radiations. For application in a coincidence circuit, the installation is supplied by blocks of detectors having crystalls of NaI. Deadtime of the channel with proportional counter equals to 4 mcs, resolution time of the coincidence circuit is variable from 0.4 to 2 mcs. To measure activity of nuclides with electron-capture decay, installation with 4π counter working under pre assure up to 2 MPa is used. Also, a method is given of determina tion of corrections in measurement by proportional counters. Corrections for self-absorption of α- andβ-particles a nd conversion electrons are determined by calculation. Self-absorption in the sources with radionuclides dacayed by electron capture is determined experimentally by means of "weightless" source which is prepared by the electrocalillar method. To check correctness of this approach, measurements of activity of ^{54}Mn has been done by the coincidence method. Deviation of the results was more than 0.3%.

38292 (INIS-mf—8981, pp vp) **Calculation of thermal effects occuring during the manufacture of CR-39 sheets. No. E/6.** Szilagyi, S.; Somogyi, G. 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780475. (CONF-830969—).

From 12. international conference on solid state nuclear track detectors; Acapulco, Mexico (4 Sep 1983).

To manufacture a good-quality, uniform CR-39 nuclear track detectors, the polymerization rate should be chosen below a critical value to avoid the development of undesirable thermal gradients and internal temperature fluctuations in the sheet being cast. To improve curing cycles, especially for thick CR-39 sheets, a computer programme was developed by which the trends of thermal effects under different casting conditions can be studied. The calculations are based on the solution of the one dimensional heat transport equation, taking into account the relations for describing the chemical kinetics of CR-39 polymerization. The empirical parameters available to such calculations were revised. With new 'Dial constants' the critical initial bath temperature (which results in thermal runaway at the central plane of the sheet being cast) was calculated as a function of the CR-39 thickness and IPP initiator concentration. Results are also presented for the temperature profile developing in the depth of cast CR-39 sheets. (author).

38293 **(INIS-mf—8981) Contributions to the 12th international conference on solid state nuclear track detectors, Acapulco, Mexico, September 4-10, 1983.** (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 60p. (CONF-830969—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780475.

From 12. international conference on solid state nuclear track detectors; Acapulco, Mexico (4 Sep 1983).

Separate entries were made in the data base for the papers presented. (WHK)

38294 (INIS-SU—236, pp 129-132) **Multiwire proportional counter for streamer chamber triggering.** Arkatov, Yu.M.; Gavrilichev, E.A.; Vatset, P.I.; Voloshchuk, V.I.; Zolenko, V.A.; Mikhno, G.I.; Popov, V.F.; Prokhorets, I.M.; Chechetenko, V.F. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Principal parameters and characteristics of a multiwire proportional counter are given. Characteristic features of electron logic developed for registration and logical analysis of counter signals controlling streamer chamber operation are considered. The counter consists of 22 separate multiwire proportional chambers (PC) forming a hodoscope of detectors located in a magnet. The PCs are placed into the common gas volume. Anode electrodes are made of a gilded tungsten wire of 20 μm diameter and high-voltage ones- of beryllium bronze of 100 μm diameter. The electronic equipment consists of 22 accelerators - pulse shapers. An accelerator-pulse shaper provides the 0.8 V signal amplitude at 500 Ohm load. Signal duration at output equals 10 ns, input sensitivity is about 1.5 mV. Experiments on the proportional chamber with a streamer chamber on a bremsstrahlung beam have shown that the counter at certain high voltage values and gas mixtures is not practically sensitive to electron background and reliably operates in up to 1T magnetic fields.

38295 (INIS-SU—236, pp 133-136) **Method for efficient measuring photon beam polarization.** Boldyshev, V.F.; Vinokurov, E.A.; Peresun'ko, Yu.P. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

To find optimum conditions for carrying out experiments on measuring photon beam linear polarization using track devices a dependence of triplet production cross section by linearly polarized photons on effective pair mass is studied. It is shown that using triplet photoproduction with selection of events within a certain range of invariant pair mass in track devices permits to attain high (up to 96%) asymmetry of the recoil electron distribution and thereby optimize photon beam linear polarization measurements.

38296 (INIS-SU—236, pp 70-73) **Development of the hardware and software for the neutron time-of-flight spectrometry.** Apanasovich, V.V.; Danilevich, V.V.; Novikov, E.V. (Belorusskij Gosudarstvennyj Univ., Minsk). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Results of studies and developments directed at creating program-controlled CAMAC devices designed for a wide-range statistical time analysis in the neutron spectroscopy are considered. The developed complex comprises: time detecting modules of signals from different radiation detectors and modules for evaluating their amplitude-time parameters; programmable selectors for time-setting pulses in present time ranges; a set of interpolation time-to-time" and "time-to-amplitude" converters; a multi-channel "time-to-code" pulse-counting type converter; an amplitude-todigital converter and a digital smoothing storage device. The above devices permit to organize multi-channel analysis of statistical time interval distributions in the up to 10^{-2} range at $2.5x10^{-10}$ resolution.

38297 **(JINR—1-83-27) Silicon in High Energy Physics.** Akimov, Yu.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701602.

The possibilities of silicon detectors for recording relativistic particles are considered. Prospects of using such detectors as fast track devices of high resolution are shown taking as examples experimental set ups. Characteristics of silicon detectors with electrodes as a few ten microns strips are described. Methods of abbreviation of a number of outputs are given: charge division on a resistive layer, capacitive division, charge storage at the helium temperature, the use of charge coupled devices. It follows from the given data that silicon detectors have better space and time responces as compared with wire chambers. Space resolution in these setups is as high as 5-10 μm.

38298 **(JINR—1-83-185) Light nucleus spectrometer based on the multidetector telescopes.** Abashidze, L.I.; Avramenko, S.A.; Avde Chikov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701600.

The spectrometer for registration of charged particles and light nuclei in the 2-50 MeV/nucleon energy range is described. The spectrometer is installed at a streight section of the JINR synchrophasotron. The semiconductor detector telescopes, the system of the spectrometric electronics, the structure and electronics for logical selection of the events , the electronics for communication and data transmission in the SM-3 computer are described. The algorithm of charged particle identification, the methods for absolute monitoring and differential cross section calculation are given. The spectrometer works at an internal beam of the accelerator. The arrangement of the telescopes together with system of their cooling and the target inside the accelerator chamber are considered.

38299 **(JINR—1-83-256) Shadow method of photographing in a streamer chamber.** Ul'man, P.; Ul'man, Kh.; Shcherbakov, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701601.

An optical device is investigated for detecting optical inhomogeneities with the aid of laser pulse technique. The device permits to reveal rapid changes of phase in transparent media. For photographing an optical device with the nitrogen pulse laser has been mounted. Its radiation was transformed into the apparent region by rodamin 6 Zh dye. With the help of this device the dark-field and bright-field methods were realized. Pictures of spark discharge channels in air and of electron tracks in a helium streamer chamber have been obtained. Their structure has been studied under different photography conditions. It is shown that the proper luminescence of particle tracks the best photographs are produced by the bright-field method.

38300 **(JINR—1-83-274) Simulation program on the base of the GEANT program for the Photon-Masser installation.** Iz"yurov, V.M.; Khachaturyan, M.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701637.

On the base of the GEANT general program system for simulating high energy physics experiments a program package for Simulating some neutral resonance production reactions has been created. New system of subprograms provides taking into account of all basic characteristics of the "Photon-Masser" installation. It could serve both for calculating the efficiency of measurements already performed, and for preparing new experiments. Electron ionization losses, production of electron-positron pairs induced by gamma-quanta, multiple scattering and electron bremsstrahlung are taken into account. The program has been used for processing results of the experiment on measurement of partial width of eta $\rightarrow \pi^0\gamma\gamma$ decay and for determining the optimal geometry of experiment on the study of cumulative production of eta- and ω-mesons. It is shown that results of calculation by this program agree well with ex. periment.

38301 **(JINR—6-82-624) Use of EC-1010 computer in a system for spectrometric information processing.** Brudanin, V.B.; Vylov, Ts.; Gopin, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701640.

The hardware and software organization of the system of acquisition and preliminary processing of spectrometric information is described. The system is based on the EC-1010 computer and CAMAC equipment. The configuration of the system is given. Programs providing operation with CAMAC modules, digital data acquisition from spectrometers, search for instrumental spectra, visual presentation and preliminary data processing are briefly described.

38302 **(JINR—10-82-641) Programs for treatment of integral perturbed angular gamma-gamma correlations.** Brudanin, V.B.; Budzynski, M.; Kochetov, O.I.; Yashin, S.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701638.

The basic calculation formulas and description of the program for fragment angular correction perturbed by static quadrupole interaction in axially symmetrical mono- and polycrystals, and by magnetic interaction in ferromagnetic samples are given. Calculation correction of finite solid angle is made for Ge(Li) and NaI(Ti)-detectors with application of common linear absorber coefficient of γ-radiation. Programs are written in fortran-IV language. The discription of the application of the program for treatment of angular correlations perturbed by hyperfine interaction and some examples are presented.

38303 **(JINR—10-82-931) Software for on-line filtering system on HPD scanning automatic device.** Belyaev, A.V.; Simonova, N.G.; Slepnev, S.K.; Susov, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701639.

Purpose, set-up and operational characteristics of the software system for on-line filtering (OLF) of data from HPD scanning device are described. The OLF complex has been designed for measurement of hydrogen bubble chamber photographs by means of on-line data filtering in the road guidance mode. It implies the software for the main CDC 1604A computer consisting of a set of programs that transfer information to each other through peripheral storage (punched cards, magnetic tapes), some of which interact with the software of the TPA 1001/i control computer. The functions of the main programs of the OLF system are described, data are presented on the possibilities, capacity and efficiency of the system.

38304 **(JINR—13-83-35) Radical silicon position-sensitive linear detector with implanted resistor.** Amov, B.; Dzhakov, A.; Osipenko, B.P.; Pentsya, E.; Sandukovskij, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701605.

Silicon position-sensitive detector with linear radial response is described. The resistive layer of the detector is obtained with the phosphor implantation. The dose of the implanted ions has a gradient along the sample radius. The n-type silicon with resistivity 6 kOhm is used. The radius of the active area of the detector is 19 mm. The nonlinearity of the detector position response is $<= 1\%$. The mentioned above detector is compared to the position detector with a homogeneous resistive layer.

38305 **(JINR—13-83-188) Timing detector with a friable dielectric emitter.** Kavalov, R.L.; Margaryan, Yu.L.; Gasparyan, S.G.; Chubaryan, G.G.; Luk'yanov, S.M.; Penionzhkevich, Yu.Eh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701603.

A detector based on a friable dielectric MgO emitter with the use of isochronous transport of secondary electrons onto a chevron assembly of microchannel plates is described. The performance (amplitude spectrums, time resolution, efficiency) at detection of α particles with energy 5.5 and 30 MeV are given.

38306 **(JINR—13-83-342) Facility for measurement of perturbed gamma-gamma angular correlations in the 1.5-300 K temperature range.** Budzynski, M.; Veprzhek, Ya.; Konichek, Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701604.

A facility purposed for investigations of perturbed gamma-gamma angular correlations in the temperature range (1.5-300) K has been described. Polarization of ferromagnetic samples can be

achieved using superconducting Helmholtz coils producing magnetic field up to 2.0 T. Sample temperature can be adjusted within +- 1.5 K in the temperature range (4-300) K. Gamma-rays are detected using Ge(Li) detectors. Correlation spectrometer has been constructed on the fast-slow coincidence principle. For data cumulation the ICA-70 multichannel analysers and the SM-3 minicomputer are used. Control measurements of angular correlations for ^{152}Sm and ^{154}Gd were performed. Hyperfine field on Gd nuclei in iron at 4.2 K temperature was determined to be B=-36.1.

38307 **(JINR—16-83-240) Investigation of the radial track etching rate in a plastic track detector as a function of the local damage density around a heavy ion path.** Apel', P.Yu.; Pretsh, G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701606.

An attempt is being made to define the sensitivity of plastic track detectors on the basis of a new concept. The main feature of this (micro) concept is the relation between the radial etching rate of a heavy ion track and the local damage density by means of a continuous function. The energy dose depending on the radial distance from the ion path is taken as a measure of the local damage density. The corresponding etching rate has been measured by the conductometric method. The sharp rise of the radial etching rate with increasing dose explains the threshold character of the track registration and confirms the applicability of the existing threschold registration criteria for the practical purposes. The dependence of the radial etching rate on the radial dose can be described by the multitarget model which explains the preferential etching by the collective activation of a given number of sensitive elements. The lower slope of the corresponding curve for γ-radiation demonstrates the substantial influence of the dose rate on this collective activation process.

38308 **(JINR—D-1-82-642) Optics, holography and mesooptics in bubble chamber of vertex detector.** Soroko, L.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701584.

It is shown that data acquisition problem in bubble chamber vertex detector of high spatial resolution can be solved by introducing the mesooptical elements. There are treated the limitations of classical imaging optics and the new scopes of holographic systems in bubble chamber technique. The typical examples of mesooptical imaging systems are presented. The application of mesooptics in te system of scanning of holograms in bubble chamber vertex detector of high spatial resolution is described. The gravitational lens (mesolens) can be considered as a typical messoptical system.

38309 (JINR—D-2-82-568, pp 92-97) **"RESONANS" device its possibilities and nearest perspectives for relativistic nuclear physics.** Askarkhodzhaev, A.A. (Tashkentskij Gosudarstvennyj Univ. (USSR)); Belyakov, V.A.; Borzunov, Yu.T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780158. (CONF-8205252—).

From Meeting on investigations in the field of relativistic nuclear physics; Dubna, USSR (25 May 1982).

A "Resonans" device - a streamer chamber with a liquid hydrogen target placed in a magnetic field of approximately 11 kgf intensity is described. The device is on a JINR synchrophasotron channel along which accelerated protons and nuclei extracted out of an accelerator and secondary particles, π^{+-} and K^{+-} mesons, from an external target are suggested to transport. A physical investigations program, which will be carried on by means of an additional device for the Resonans device - a hodoscope of the Cherenkov complete absorption counters - which permits to detect and measure gamma quanta, was considered. Space and charge correlations will be studied as well as effective masses of secondary particle combinations. In the case of the polarized deuteron irradiation the experimental material will be used to solve the problem of the manifestation of six-quark deuteron structure.

38310 (JINR—D-2-82-568, pp 114-119) **Cumulative hadron spectrometer at the inner target of an accelerator.** Belyaev, I.M.; Bondarev, V.K.; Gavrishchuk, O.P. 1982. (In Russian). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780158. (CONF-8205252—).

From Meeting on investigations in the field of relativistic nuclear physics; Dubna, USSR (25 May 1982).

To investigate cumulative hadrons in 10-70 GeV primary proton energy range, the detection of secondary particles during continuous beam incidence onto an internal target of the IHEP accelerator in a growing magnetic field is suggested to use. To measure the inclusive hadron yield in 0.2-1 GeV secondary particle energy range, a one-arm magnetic spectrometer is suggested to Use. The data recording and analysis are intended to be performed with the CAMAC system on line with an electronic computer. A secondary particle spectrometry method is described, an experimental device flowsheet realizing the method suggested is given, possibilities of its improvement are evaluated. The spectrometer improvement makes it possible to study in more details the dynamic of the cumulative particle production in such processes as the cumulative production of vector mesons, identical particle interference, the cumulative production of particles with heavy quarks.

38311 **(JINR—E-5-82-855) Busy period of discretized GI/GI/infinity queue.** Dvurecenskij, A.; Ososkov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701585.

The problem of determining the distribution of the busy period, i. e., of the time when at least one customer is served, of the discretized queueing system with infinitely many servers is investigated. Moreover, the idle period and the cycle of a queue are studied. The recurrent formulae are determined and in particular case of a queue with the geometric input the simpler recurrent formulae are given. Those problems arise in the discrete blob length determination in track chambers in high energy physics.

38312 **(JINR—R-1-83-390) Method for determinining the charged particle momenta under the "Hyperon" set-up conditions.** Vinogradov, V.B.; Odintsov, V.G.; Kul'chitskij, Yu.A.; Kurilin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701586.

The method and developed on its base programmes for the determination of the charge particles momenta under the conditions of the "Hyperon" set-up are described. The magnetic field card of the spectrometric electromagnet which contains 415000 values, is substituted by a set of 2500 factors of the Chebyshev polynomials used for the reconstruction of the charged particles momenta. Due to the described method the momentum determination error is 0.1-0.2 per cent. The average reconstruction time of the single particle momenta does not exceed 0.1 s for the EC 1060 computer.

38313 **(JINR—R-1-83-434) Simulation of the DISC-2 spectrometer efficiency by the Monte-Carlo method.** Baldin, A.M.; Bondarev, V.K.; Giordehnesku, N.; Litvinenko, A.G.; Moroz, N.S.; Panebrattsev, Yu.A.; Pentsiya, M.; Rikhvitskij, S.V.; Stavinskij, V.S.; Khrenov, A.H. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701607.

The production and detection processes of the secondary particles, taking into account the interactions effects in the target and material of the DISC-2 spectrometer, are described by the Monte-Carlo simulation. The input solid angle distribution, the spectrometer acceptance, the scattering and energy loss corrections in the spectrometer channel are calculated. The experimental time-of-flight spectra are simulated. The coincidence within the 10% accuracy of the simulation results and experiments on the determination of efficiency of a spectrometer with additional scatters is obtained and of count distributions in the time-of-flight spectra for different types of particles detected within the 300 upto 1000 MeV/c momentum range.

38314 **(JINR—R-5-82-662) Busy period of discretization queuing system.** Dvurechenskij, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701597.

By the method of recurrent events the reproducing function, the mean value, and the distribution of the number of customers, served during the busy period of a queueing system GI/GI/GI/infinity with a discretized input and infinitely many servers are investigated. In the case of the simplest flow and the discrete service time, the Laplace transforms and the mean values of the busy period and their cycle are determined. As a particular result the mean value and the Laplace transform of the discretized streamer blob length are obtained.

38315 **(JINR—R-5-82-663) Number of observable customers, served during he busy period of GI/GI/infinity queue.** Dvurechenskij, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701598.

It is proved that the number of observable customers, served during the busy period of the GI/GI infinity queue with infinitely many servers has a geometric distribution. The parameter of this distribution is determined, too. It is shown that the normalized distributions converge to the exponential distribution. As a particular result is obtained that the distribution of the number of nonabsorbing streamers in a streamer blob has a geometric distribution.

38316 **(JINR—R-7-83-332) Douhle ionization chamber for fission fragment detection.** Chepigin, V.I.; Stepantsov, S.V.; Nad', Sh.; Ter-Akop'yan, G.M.; Chelnokov, L.P.; Voronin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84701599.

Some problems associated with studies on the spontaneous fission of transfermium elements are considered, and advantages of ionization chambers over other detectors for fission fragment detection are discussed. A double ionization chamber for detecting fission fragments (5x30 cm^2 - maximum size of the source) has been built, and the energy and mass calibrations have been performed using the thermal neutron-induced fission of sup(235)U: σsub(TKE)=10.9 MeV, σsub(Asub(L))=6.2 a. m. u. The accuracy of determining fission fragment flight angle is 3 deg - 8 deg in the 60 deg - 30 deg angle range, respectively. The use of a gas jet, in combination with a double ionization chamber as a detector, together with a neutron detector of ^{3}He counters, in experiments with heavy ions is discussed. In a model experiment with a "thick" ^{235}U source (approximately 0.7 mg/cm^2 over N_3) the proper accuracy of determination of the total kinetic energy and σsub(TKE) approximately 12 MeV has been achieved.

38317 **(JINR—R-10-82-653) Data compression at a filmless data output from a streamer chamber. Pt. 3. Software imitator of the ASD special processor.** Bajla, I.; Ososkov, G.A.; Prikhod'ko, V.I.; Turzova, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701636.

A method of on-line data compression intended to hardware implementation in the filmless data readout system is co sidered. The method consists of two parts: special sorting and linear approximation. It provides a required precision and preserves the information about the structure of track gaps needed for the determination of ionization. Two versions of the first part algorithms for track element linking and the second part algorithms of the fast piecewise linear approximation of track segments are developed as a software imitator of the ASD special hardware processor. The real data processing from the RISK spectrometer yields 8:1 compression ratio for the single compression and 3:1 compression ratio when nonidentified print coordinates are stored moreover. The 2.5 mm renewed precision are preserved in both cases.

38318 **(JINR—R-10-83-370) Time interval processor for preprocessing the data from proportional chamber with delay lines.** Ivanov, A.B.; Chernenko, S.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701587.

A CAMAC time interval processor for preprocessing the data from MWPC with delay lines is described. The module is oriented to readout signals from two ends of delay lines. Selection of events which have one and only one pulse in all readout channels for total delay time is performed. For a high data flux the module fulfills signal switching to one of two time-to-digital converters.

38319 **(JINR—R-13-82-637) Analytical computation of the geometrical efficiency of the registration by a cylindrical detector of particles scattered in a distributed target.** Balestra, F.; Garfan'ini, R.; Piradzhino, G.; Lyashenko, V.I.; Panyushkin, V.A.; Pontekorvo, D.B.; Falomkin, I.V.; Shcherbakov, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701588.

A way of computing the geometrical efficiency of scattered particles detection with a cylindrical hodoscopic detector is described. In computing the average value of the geometrical efficiency the corresponding region of integration was divided into bins and integration was performed by the standard Simpson method. In this case the accuracy of the computation does not in any way depend on the possible statistical fluctuations of the distribution of the simulated events, as in the case of the Monte Carlo method. The described method can be applied to cylindrical detectors of any configurations. The obtained results of calculations coincide with calculations obtained by the Monte Carlo method, that is illustrated by the results of calculations presented for a concrete system, namely the JINR high-pressure streamer chamber.

38320 **(JINR—R-13-83-143) RISK spectrometer high-voltage system. Control and stabilization system of streamer chamber high-voltage supply.** Vertogradov, L.S.; Grishkevich, Ya.V.; Lomtadze, T.A.; Tokmenin, V.V.; Fedorovich, Yu.; Shelkov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701590.

The charging supply system for a bipolar pulse generator of the Arkadiev-Marx type is described. It is part of the high voltage system for the streamer chamber spectrometer RISK. The flowsheets and the time diagram are presented. The parameters of the system are: the voltage supplied can be held within the limits (5-30) kV, the output voltage is stable within the 0.5%, the minimum time of charging equals 50 ms. Possibilities of increasing speed of response of the system are considered.

38321 **(JINR—R-13-83-145) RISK spectrometer high-voltage system. Timing and control of high-voltage system parameters.** Vertogradov, L.S.; Lomtadze, T.A.; Khomenko, B.A.; Shelkov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701591.

The system for tuning and control of high voltage system parameters of the RISK spectrometer is described. Eleven time-amplitude parameters of this system are measured and controlled. These parameters were obtained from ten resistive and capacitive probes positioned in the main units of the high voltage system. The ES-1040 computer receives, controls and transfers data to magnetic tape. The procedure of tuning the high-voltage system with a computer processed data is described.

38322 (JINR—R-13-83-152) Risk spectrometer high-voltage system. Bipolar generator up to +-600 kV pulse amplitude. Bannikov, A.V.; Vertogradov, L.S.; Dzhavrishvili, A.K.; Lomtadze, T.A.; Kharchilava, A.I.; Shelkov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701592.

The bipolar high-voltage pulse generator of the streamer chamber of the RISK spectrometer is described. The generator has the following characteristics: it provides a high voltage up to +-600 kV, supply voltage +-25 kV, charge capacity - 0.6 μF, discharge capacity for each aron is 950 nF and an internal inductance - 1.8 μH. The generator possesses a high stability and a reliability (more than 10^5 pulses).

38323 (JINR—R-13-83-154) Laser deuterium streamer chamber-target at 5 atm in the self-shunting regime. Ivanov, I.Ts.; Lyashenko, V.I.; Panyushkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701593.

Electron track interference patterns along the electric field in the deuterium high pressure streamer chamber were registered at 5 atm. The holograms were obtained with Rodhamin 6G dye laser pumped by a nitrogen pulse laser in the Gabor holographic scheme. The chamber worked in the so-called "self-shunting" regime. The value of the streamer density is 9+-2 str/cm is independent on the laser pulse time-delay. The registered streamer centers root-mean-square deviation from the electron trajectory is 80 mkm. The real streamer diameter is 120 mkm and was estimated from comparison streamers with the diffraction pictures of the electrode wires.

38324 (JINR—R-13-83-183) High pressure laser streamer chambers operating with small regulating admixtures to the working gas. Budzyak, A.; Bobrova, N.P.; Bentse, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701594.

The conditions of electron track registration in helium and hydroger streamer chambers at 5 atm have been investigated. The track images are obtained by means of holographic registration with the aid of a pulse dye laser. The electron tracks in the helium streamer chamber were registrated using small admixtures of methane to the working has been within 0.01-0.09%.

38325 (JINR—R-13-83-198) Simple and cheap laser system for holographic read-out from vertex detector. Bartke, E.; Ivanov, I.Ts.; Ehksnerova, Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 1gp. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701595.

It is shown that good-quality holograms of thin glass fibres imitating tracks in the bubble chamber model can be obtained using a simple and cheap, hand made laser system consisting of a dye laser on Rhodamin 6J pumped with a pulsed nitrogen laser. The in-line (Gabor) holographic scheme was used. Images reconstructed from holograms obtained with the pulsed dye laser and with a continuous helium-neon laser are compared and found to be of similar quality.

38326 (JINR—R-13-83-419) Device for growing and thermal treatment of silver chloride sheets as detectors of ionizing radiation. Bradna, F.; Bradnova, V.; Yukl, F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701596.

A short review on technology of preparing AgCl crystals as detectors of ionizing radiation is given. The device, constructed for growing and thermal treatment of these crystals is described. Since sensitivity of crystals as detectors is strongly influenced by the thermal treatment during the growth, the device must make zone of constant temperature, the time of annealing and cooling down to be between 5 deg C/h to 1000 deg C/h. Limit temperature program is shown. The device described allows one to study dependence of sensitivity of AgCl detectors on thermal treatment program.

38327 (KFTI—83-28) Control system for wire spark chambers on electron beam of the 2 GeV Khapkov linac using multi-computer complex. Bratashevskij, A.S.; ZybaloV, A.A.; Karasev, S.P.; Konovalov, O.G.; Tenishev, A.Eh. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701611.

Software of diagnostic system of wire spark chambers on the beam of LUEh-2000 MeV KhFTI accelerator using multi-computer complex is developed and tested. The programs are realized using FORTRAN-EC language. Their working capacity is tested under real conditions of experiment. Using the programs it is possible to realize tuning of the telescope of wire spark chambers before experiment and to follow its work and quality of information from the telescope. The testing has shown convenience and reliability of the programs in operation.

38328 (LA—9933-C-Vol.2, pp 640-648) **High-rate detectors.** Hartill, D. (Cornell Univ., Geneva, NY). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Tracking detectors are discussed, with particular attention given to momentum resolution and high-rate design criteria for drift chambers. Results are presented for improved spatial resolution in the CLEO Drift Chamber using the data to survey the chamber. Recent results obtained by H. Walenta for very high rates in a mini-drift chamber prototype are also reported.

38329 (LA—9933-C-Vol.2, pp 649-662) **MPS II - a tracking detector system for large high-rate experiments.** Platner, E.D. (Brookhaven National Lab., Upton, NY). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—). Contract AC02-76CH00016.

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The MPS II tracking detector system was developed for a variety of low cross section experiments that are only practical in a high beam rate environment. It was built as a general-purpose device for use in a fixed-target (AGS) situation where the beam passes through all elements of the detector. The electronics is dead-timeless so that high efficiency is achieved at event rates as high as 10^6/sec/ch. This capability would allow these detectors to be used as close as 20 cm from a hadron-hadron collider at 1 TeV of luminosity up to 10^{33}/cm^2/sec.

38330 (LA—9933-C-Vol.2, pp 682-687) **Kaon detectors.** Thomson, G.B. (Rutgers Univ., New Brunswick, NJ). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The Kaon Detector session concentrated on detector and beam requirements for K/sub L/^{0} experiments. The material covered was: designing a K/sub L/^{0} decay detector; using this detector for K/sub L/^{0}→μe; beam requirements for the above; and K/sub L/^{0} + p elastic and regenerative scattering.

38331 (LA—9933-C-Vol.2, pp 691-699) **Detector concept for stopping beam experiments for LAMPF II intensities: a rare muon decay detector as an example.** Sanders, G.H. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

A major class of experimental detectors at LAMPF II will be those designed for use with stopping beams. In physics with LAMPF II, several experiments are identified requiring large solid-angle, modular stopping-beam detectors. Such detectors would also be used to reach the lowest possible branching ratios in the search for lepton-number nonconserving muon decays. It is appropriate now to consider how such a detector might be configured.

38332 (LA—9933-C-Vol.2, pp 875-885) **Instumentation for handling high-intensity separated beams.** Pile, P. (Brookhaven National Lab., Upton, NY). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

A drift chamber system capable of handling beam rates of the order of those expected from LAMPF II is described. A schematic is shown and chamber parameters are given. Rate limitations, electronic deadtime event multiplicity and chamber lifetime are considered.

38333 **(PNL—5112) Develop real-time dosimetry concepts and instrumentation for long-term missions.** Braby, L.A.; Ratcliffe, C.A.; Metting, N.F.; Lien, M.K. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 156p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015015.

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The objective was to develop a small, self-contained system to measure dose and evaluate dose equivalent in real time in the complex radiation environment encountered in space. The device utilizes a microdosimetric approach. The instrument consists of two propane filled proportional counters, one of which measures energy deposition by penetrating radiations with LET between 0.24 and 200 keV/μm. The second detector is intended for particles with LET $\geq$ 200 keV/μm for a minimum of 100 μm. This detector is physically larger in order to obtain reasonable counting statistics on these infrequent micro lesion-forming events. The detectors are combined with an electronic system which consists of three multichannel analyzers with independent analog to digital converters, computer controlled detector bias supplies, signal conditioning amplifiers, data recording and display devices and a microcomputer which controls the system and calculates dose and dose equivalent. This report includes a brief discussion of microdosimetry as it applies to health physics, an evaluation of different methods for calculating dose equivalent, descriptions of the hardware and software making up the prototype instrument and the results of evaluations of the instrument when exposed to a variety of radiations. Included are operating instructions, software listings, and circuit diagrams. 18 references, 9 figures, 8 tables.

38334 **(RFP—3653) Radiochemical determination of plutonium in glass fiber filters.** Trice, C. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 12 Jun 1984. Contract AC04-76DP03533. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015456.

Multi-filter ambient air samples were analyzed to determine percent recovery and sensitivity at levels necessary for ambient air monitoring. The average percent recovery of plutonium-236 in ambient air samples using S and S glass fiber filters and analytical results for S and S glass fiber filters spiked with plutonium-239 at a concentration of 4.03 dis/min are tabulated.

38335 **(RL—83-101) Tests of high resolution two-beam holography in a model of the Big European Bubble Chamber, BEBC.** Bjelkhagen, H.; Pouyat, F.; Kasper, P.; Miranda, E.E.; Sekulin, R.L.; Venus, W.; Walton, L. (Rutherford Appleton Lab., Chilton (UK)). Nov 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702572.

To be published in Nuclear Instruments and Methods.

A method is described which is used to take holograms of test objects in a configuration where a large volume, simulating the BEBC bubble chamber, was viewed through a single viewing port containing aberrating optical elements and where illumination is achieved using "Scotchlite' retroreflectors. Using a simple method of speckle averaging in replaying the holograms, wires with diameters >= 20 μm, situated at approx. 2 m from the limiting optical aperture, were reconstructed with an effective resolution of approx. 40 μm. The application of the technique to the conditions of an operating bubble chamber is discussed.

38336 **Performance characteristics of A150 plastic-equivalent gases in A150 plastic proportional counters for 14.8-MeV neutrons.** DeLuca, P.M. Jr.; Schell, M.C.; Pearson, D.W.; Higgins, P.D.; Attix, F.H. (Department of Medical Physics, University of Wisconsin-Madison, Madison, Wisconsin 53706). *Medical Physics;* **11**: No. 4, 449-455(Jul 1984). Contract AC02-76EV01105.

Two recently developed A150 plastic-equivalent gas mixtures have been tested for suitability in proportional counter applications. Methane- and propane-based "tissue-equivalent" gases were also included for comparison purposes. Event-size weighted dose distributions were measured in a 14.8-MeV neutron beam. Resolution was found to be independent of gas mixture. Moreover the gains of the two A150 mixtures were the same, and comparable to that of the methane-based gas mixture. The ionization yield per event size was also independent of the hydrogenous gas mixture employed. Neutron doses determined with the proportional counter were in reasonable agreement with those obtained from an ionization chamber.

38337 **Microchannel plate electron multiplier for mass spectrometer applications.** Liptak, M.; Rosenbauer, H.; Sandie, W.G.; Shelley, E.G.; Simpson, D.A. (Lockheed Palo Alto Research Laboratory 3251 Hanover Street Palo Alto, California 94304). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 780-785(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A prototype microchannel electron multiplier has been tested for use in a satellite-borne mass spectrometer to be flown on the GIOTTO cometary mission. In the mass spectrometer application position, information is obtained both from discrete anodes deposited on the back face of the microchannel plate (contact anodes), as well as from discrete remote anodes. Pulse height distributions from remote and contact anodes are found to be comparable. Crosstalk between contact anodes, although acceptably low (about 1:50), was larger than expected for the amplifier gain, bandwidth, and integration periods used. Scans across the plate were made using a highly collimated beam of electrons that was small with respect to the channel diameter, allowing the boresighted response to be determined. The electron beam intensity was varied to measure gain G(n) and depression versus count rate n for single channel excitation. Where the channel recovery time Γ is about 0.060 s, $G(n) = G(o)/(1 + \Gamma n)$. The mass spectrometer configuration requires the use of a grid placed in front of the MCP to accelerate ions to detectable energy. A strong field for ions could diminish the gain of the MCP by extracting the initial secondary electrons produced at the front of the channel. The effect of accelerating fields on the efficiency of the MCP was investigated using energetic alpha particles and found to be small for fields of practical interest.

38338 **Design criteria for a high-dose MOS dosimeter for use in space.** August, L.S. (Naval Research Lab., Washington, DC 20375). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 801-803(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

In a previous paper a small, light-weight, low-power integrating dosimeter is described that is designed for use aboard satellites where the expected total dose is below 30 krad. The radiation-detecting sensors employed are radiation-soft, PMOS transistors. The dosimetric parameter utilized is the shift in threshold voltage, $\Delta V/SUB T/$. This voltage shift is related to the radiation dose absorbed, D, in the SiO_2 gate oxide of the transistor. The relationship between $\Delta V/SUB T/$ and D is determined with a calibrated Co-60 gamma-ray source. The present paper gives experimental results from which design criteria are derived that will extend the use of the dosimeter into the megarad range. The data show that the existing PMOS transistors can be operated in either of two ways. With a high positive gate bias during irradiation, and with some circuit modification, the PMOS transistors are useful up to about 50 krad. When the source, drain, and gate are grounded during irradiation, and subsequently read out normally, the devices are usable up to

approximately 2.5 Mrad. The underlying device physics for these two modes of operation is discussed.

38339 **Gamma-ray imaging with a rotating hexagonal uniformly redundant array.** Cook, W.R.; Finger, M.; Prince, T.A.; Stone, E.C. (California Inst. of Technology, Pasadena, CA 91125). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 771-775(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

Laboratory experiments have been performed to demonstrate the capabilities of a γ-ray imaging system employing a NaI Anger camera and a rotating coded aperture mask. The mask incorporates in its design a new type of hexagonal uniformly redundant array (HURA) which is essentially antisymmetric under 60° rotation. The image formation techniques are described and results are presented that demonstrate the imaging capability of the system for individual and multiple point sources of γ-ray emission. The results are compared to analytical predictions for the imaging and point source localization capabilities of coded aperture systems using continuous detectors.

38340 **The EXOSAT imaging x-ray detectors.** Mason, I.M.; Branduardi-Raymont, G.; Corbet, R.H.D.; Culhane, J.L.; Ives, J.C.; Sanford, P.W. (Mullard Space Science Laboratory Department of Physics and Astronomy University College London Holmbury St. Mary Dorking, Surrey). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 795-800(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The European X-ray Observatory Satellite (EXOSAT) was launched in May 1983. Its payload includes two x-ray telescopes, whose images are registered by either an imaging proportional counter (PSD) or a channel multiplier array detector (CMA). The authors describe the design, construction and pre-flight performance of these detectors. They also present preliminary in-orbit performance data. Finally, they summarise recent work on improving these detectors for possible use in future payloads such as the Advanced X-ray Astrophysics Facility (AXAF).

38341 **Broad band X-ray astronomical spectroscopy.** Serlemitsos, P.J.; Birsa, F.; Glasser, C.; Petre, R. (Lab. for High Energy Astrophysics, NASA/Goddard Space Flight Center, Greenbelt, MD 20771). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 786-790(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The Broad Band X-Ray Telescope (BBXRT) experiment has been designed for high sensitivity, moderate resolution spectrophotometry of cosmic sources in the range 0.5 to 12 keV. Principal elements are two co-aligned imaging telescopes with cooled Si(Li) detectors at each focus. The mirror design uses an approximate geometry of tightly nested, conical, foil reflectors that allow a large filling factor (high throughput) at small grazing angles (high energy response). Each detector consists of a cluster of 5 elements defined with grooves on a single crystal. This arrangement affords some spatial resolution as well as a means of substantial background reduction. Shuttle borne measurements will typically be of 2000 s duration for sources with a flux of 10^{-12} ergs/cm^2-s.

38342 **A position sensitive detector system consisting of an array of mini-proportional counters.** Van Beek, H.F.; Boelee, A.; Mels, W.A.; Van Der Laan, J.J.M. (Space Research Laboratory Beneluxlaan 21 3527 HS Utrecht). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 791-794(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A new position sensitive detector system has been developed for the Hard X-ray Imaging Spectrometer launched aboard the NASA Solar Maximum Mission. The instrument operates in the energy range 3.5 - 30 keV. The Xe-gas filled detector system consists of a photon absorption compartment and an array of 900 miniproportional counters. The detector lay-out and the system performance are described.

38343 **The fine grid detector: a parallel electrode position sensitive detector.** Hendrix, J. (European Molecular Biology Laboratory, Notkestrasse 85, 2000 Hamburg 52). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 281(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A parallel electrode type of position sensitive detector with a fast delay-line read-out system has been developed. As a preliminary result, a spatial resolution of 0,5mm FWHM has been obtained. The counting rate capability is as high as 10^5 sec $^{-1}$ mm^{-}.

38344 **Alternatives to coaxial cable for delaying analog and digital signals in a particle physics experiment.** Sandoval, J.P.; Bayliss, L.; Gordon, T.; Hart, G.; Hoffman, C.M.; Hogan, G.E.; Sandberg, V.D.; Sanders, G.H.; Wilson, S.L. (Los Alamos National Lab., NM). *Nuclear Instruments and Methods in Physics Research;* **216**: No. 1/2, 171-176(15 Oct 1983).

The use of distributed and lumped-constant delay lines as substitutes for coaxial cable to delay analog and digital signals is discussed. Construction of multichannel modules to delay NIM signals by 350 ns, and to delay photomultiplier signals by 400 ns are described.

38345 **Extension to the Feynman method of detecting fission neutrons.** Brunson, G.S. (Los Alamos National Lab., NM). *Nuclear Instruments and Methods in Physics Research;* **214**: No. 2/3, 341-348(1 Sep 1983).

The Feynman method of analyzing a neutron flux has been widely used to characterize systems in which fission neutrons are present. John T. Caldwell of the Advanced Nuclear Technology group of the Los Alamos National Laboratory proposes a variation of this technique in which each sample gate is initiated by a neutron count. We compared the two methods for a few specific cases and found the second method markedly superior. Moreover, it is possible to combine the two methods and obtain information about single chains that is not available when either method is used along. For example, the combined methods permit us, without knowing the counter efficiency, to estimate the fraction of fission neutrons in an unknown neutron flux.

38346 **Complete fragment yields from spallation reactions via a combined time-of-fight and ΔE-E technique.** Mathews, G.J. (California Univ., Livermore). pp 317-320 of Composition and origin of cosmic rays. Shapiro, M.M. Dordrecht, Netherlands; Reidel (1983). (CONF-8206171—).

From 3. international school of cosmic ray astrophysics; Erice, Italy (20 Jun 1982).

A technique for measuring spallation cross sections of interest for cosmic-ray propagation calculations is described. This technique utilizes micro-channel-plate devices for time-of-flight mass identification and a gas-ionization-counter telescope to measure charge. Preliminary results from the 180 MeV/N p + ^{27}Al reaction are reported.

38347 (JINR—R-1,2,13-83-81, pp 19-23) **Liquid scintillation counter performances for neutrino calorimeter.** Bozhko, N.I.; Vovenko, A.S.; Goryachev, V.N.; Kochetkov, V.I.; Mukhin, A.I.; Poletaev, V.I.; Salomatin, Yu.I.; Chernichenko, S.K.; Shchukin, G.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780157. (CONF-820192—).

From 3. working conference on IPHE-JINR neutrino detector; Dubna, USSR (18 Jan 1982).

In order to choose an optimum design of a liquid scintillation counter for a neutrino detector some of its modifications were tested on cosmic particles. Dependences of signals from each of

two photomultipliers, the sum of signals and their difference on particle coordinates characterizing homogeneity of light collection and energy resolution of the detector for existing and proposed designs are given. It is shown that homogeneity of light collection from a counter with optimum size can be essentially improved by removing optical lubrication on the boundary between a photomultiplier and a light guide.

38348 (JINR—R-1,2,13-83-81, pp 148-151) **Possibility of solar neutrino detection.** Gulkanyan, G.R.; Pogosov, V.S.; Tamanyan, A.G. (Erevanskij Fizicheskij Inst. (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780157. (CONF-820192—).

From 3. working conference on IPHE-JINR neutrino detector; Dubna, USSR (18 Jan 1982).

A possibility of solar neutrino detection by registering recoil electrons from the ν-e scattering process is considered. The device is based on multielectrode multiwire proportional or ionization chamber, operating volume of which is a cavity in a salt seam with appropriate size filled with a working gas up to pressure of 100 atm and above. Valid and background events are estimated. The conclusion is made that the given method will permit to detect solar neutrinos.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

38349 (SAND—84-0620C) **Gamma-induced leakage in junction field-effect transistors.** Allen, D.J.; Coppage, F.N.; Hash, G.L.; Holck, D.K.; Wrobel, T.F. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 13p. (CONF-840712—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014990.

From 21. IEEE annual conference on nuclear and space radiation effects; Colorado Springs, CO, USA (22 Jul 1984).

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Junction field-effect transistors are normally considered to be hard to gamma and neutron effects. However, for several types of devices, we measured an increase in the gate to body leakage current which is significant in low-power circuits. Data is presented for two device structures irradiated at three different dose rates; 1E9 rad(Si)/s, 5.5E2 rad(Si)/s and 0.9 rad(Si)/s. Parameter measurements on the devices before and after radiation indicate that the leakage results from a surface inversion caused by oxide hole-trapping under the interdigitated source and drain metallization. This conclusion is supported by the time dependent decay in leakage current after radiation and by the lower leakage levels observed on devices that have a highly doped guard-band around the channel diffusion.

38350 (SAND—84-1335C) **Comparison of conventional ^{60}Co testing and very low dose-rate irradiation of metal-gate CMOS ICs.** Roeske, S.B.; Edwards, W.H.; Zipay, J.W.; Puariea, J.W.; Gammill, P.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 13p. (CONF-840712—8). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014986.

From 21. IEEE annual conference on nuclear and space radiation effects; Colorado Springs, CO, USA (22 Jul 1984).

Data are presented for one family of Hi-Rel, rad-hard, metal-gate CMOS ICs which show a much greater tolerance to very low dose-rate ionizing radiation than that predicted by conventional-rate (approximately 10^6 rads(Si)/hr) ^{60}Co testing. Data obtained using the conventional rate ^{60}Co irradiations followed by either a 24 hour, high-temperature (100°C) or 65 day room temperature anneal are in good agreement with data obtained by exposing similar parts at a very low dose accumulation rate (5000 rads(Si)/day) for 200 consecutive days. The similarity between these findings and the rebound phenomena is described, and the implications of these findings for space and other low dose-rate applications is discussed. A simple test procedure for identifying low dose-rate annealing, or rebound, and its recovery time is proposed. Graphs of thresholds, output drive, and propagation delay versus low dose-rate and conventional-rate dose accumulation are included.

38351 (SAND—84-1555C) **Transient radiation upset simulations of CMOS memory circuits.** Massengill, L.W.; Diehl-Nagle, S.E. (North Carolina State Univ., Raleigh (USA). Dept. of Electrical and Computer Engineering). 1984. Contract AC04-76DP00789. 20p. (CONF-840712—7). NTIS, PC A02; 3; GPO Dep. Order Number DE84014985.

From 21. IEEE annual conference on nuclear and space radiation effects; Colorado Springs, CO, USA (22 Jul 1984).

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A computer simulation technique has identified and modeled a dominant mechanism for transient ionizing radiation induced logic upset in certain CMOS integrated circuits. This mechanism, termed rail span collapse here, has accounted for the discrepancy between simulated upsets of these circuits using only local radiation induced photocurrents and the experimentally observed upset dose-rate levels.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 44030038279

38352 (IKE—5TF-538-82) **Studies on the improvement of contact-free temperature measurement and determination of energy transport processes by thermal radiation in industrial production.** Woerner, B.; Neuer, G. (Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (Germany, F.R.)). Sep 1982. 94p. (In German). Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (Germany, F.R.).

Investigations whereby steels are oxidized under defined conditions and simultaneous measurement of the degree of or changes in emission is made form the subject of this report. The technique of measurement, problems of calibration and evaluation procedure are described. Spectral emissivity at wavelengths 0.7, 0.85, 1.0 and 1.6 μm and total emissivity was measured at temps. between 500°C and 1100°C. Changes with time in the range 10 sec. to 15 min. were determined. A new sample was used for each oxidation parameter so that the surface films formed could be subsequently studied by chemical analysis, metallographical grinding, X-ray structural analysis and Auger-electron spectroscopy. The investigations were oriented towards two concrete areas of application: 1) pyrometric temperature measurement for thermal strip rollers, b) calculation of radiation transport in continuous furnaces. The results of measurements for carbon steel C70, structural steel, transformer plate and cold-rolled Cr-Ni steels 1.4541 and 1.4301 are presented and discussed in terms of a number of aspects: influence of oxidation temperature, emissivity behaviour with time, influence of surface treatment, spectral behaviour of various materials, deviations of measured, uncorrected temperatures from the actual temperatures, influence of moisture content of the air. The evaluation has shown for example that in the correction of ratio temperatures deviations from -50 K to 1100 K can occur in measurements on various materials.

38353 (IS—4849) **Quarterly report, July 1, 1983-September 30, 1983.** (Ames Lab., IA (USA)). Feb 1984. Contract W-7405-ENG-82. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014871.

Progress is reported in the following areas: (1) Laser excited Shpol'skii spectroscopy (LESS); (2) Laser induced, tunable molecular ionization with TOF mass spectrometry; (3) Fluorescence line narrowing spectroscopy; (4) Rotationally cooled fluorescence spectroscopy (RCFS); and (5) Measurement of vapor, liquid and particle effluents from energy process. (ACR)

38354 (IS—4856) **On-line instrumentation for the real-time monitoring of polynuclear aromatic hydrocarbons in the effluents from a fluidized bed combustor - a feasibility study.** D'Silva, A.P.; Iles, M.; Rice, G.; Fassel, V.A. (Ames Lab., IA (USA)). Apr 1984. Contract W-7405-ENG-82. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015007.

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When polynuclear aromatic hydrocargons in the vapor phase are diluted preferably in a rare gas and undergo supersonic jet expansion, rotationally cooled molecules with absorption bandwidths of the order of 0.01 nm (FWHM) are obtained. Selective excitation with a tunable dye laser into such narrow absorption bands leads to the observation of highly specific luminescence spectra. Such an approach has been utilized for the on-line, real-time monitoring of polynuclear aromatic hydrocarbons in the effluents from a fluidized bed combustor.

38355 **(IS—4859) Quarterly report, October 1, 1983-December 31, 1983.** (Ames Lab., IA (USA)). Apr 1984. Contract W-7405-ENG-82. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014869.

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Progress is reported in the following areas: (1) laser excited Shpol'skii spectroscopy (LESS); (2) laser induced, tunable molecular ionization with TOF mass spectrometry; (3) fluorescence line narrowing spectroscopy; (4) rotationally cooled fluorescence spectroscopy (RCFS); and (5) measurement of vapor, liquid and particle effluents from energy processes. (ACR)

38356 **(JINR—18-83-292) Television display systems in High Energies Laboratory facilities for medical-biology research.** Anisimov, Yu.S.; Ivanov, A.B.; Cheremukhina, G.A.; Chernenko, S.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701610.

The principal features of TV display systems in medical biology investigations are described. Three types of TV displays used in medical devices of High Energies Laboratory, JINR with positive sensitive detectors are considered. The interfaces in CAMAC standard that providE the operation of these systems both in autonomous detection systems and on-line with a computer are described. To improve the interpretation of medical diagnostics data special programs for digital image processing are created. The application of TV display systems for image visual representation in radiochromatography, crystallography, ionic radiography, nuclear medicine is described.

38357 **(JINR—R-8-83-159) Possible use of the Allen-Bradley low temperature thermometers for particle beam detection.** Vasil'ev, P.G.; Vladimirova, N.M.; Goncharov, I.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 10p. (In Russian). (CONF-8310261—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701553.

From International conference on physics and technique of low temperature; Varna, Bulgaria (1 Oct 1983).

Results on the investigation of time characteristics of the temperature response of immersed in liquid He small sized Allen-Bradley carbon resistor-thermometers under pulse bombardment by relativistic α-particles and protons in various heat relaxation conditions are presented. It is found that, in general, similar low temperature thermometers can be used as calorimetric detectors or high energy particles. The range of its possible applicability at different pulse duration and heat relaxation time is given.

38358 **(JINR—R-13-83-121) Main parameters of inclined coordinate X-ray diffractometer based on a plane multiwire proportional chamber with fast delay lines.** Popov, A.N.; Khejker, D.M.; Zanevskij, Yu.V.; Chernenko, S.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701589.

Characteristics of coordinate X-ray diffractometer KARD-3 based on a plane multiwire proportional chamber (MWPC) with fast delay lines are described. The main parameters of the KARD-3 are as follows: a maximum lattice parameter - 90 A, 130 A, 180 A, resolving power - 1.o A, 2.5 A, and 3.5 A for distances between a crystal and MWPC 300, 500 and 750 mm, respectively at directing a primary beam to the MWPC corner; detection efficiency for CuKsub(α) radiation (8 keV) - 70%; maximum counting rate - 250 kHz at (25% events losses); factor of accelerating the exposure time with a simultaneous dose decreasing as compared with one-channel diffractometer - 50.

38359 **(RFP—3623) Evaluation of thermocouple junction temperature.** Thompson, R.L.; Stant, R.S.; Szeluga, D.K. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 10 Jun 1984. Contract AC04-76DP03533. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015159.

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The ice point (0°C) is the most important temperature in thermocouple measurements. For inter-laboratory reproducibility most thermocouple calibration curves are referenced to the ice point. Therefore, before one can accurately interpret a thermocouple's voltage output, the accuracy of the reference junction (0°C) must be known. The literature has worked on a variety of ice baths, but not on the procedures used at Rocky Flats for ice baths. The purpose of this study is to evaluate and report on the variety of ways the Rocky Flats Physical Metrology Laboratory (PML) creates or simulates a 0°C environment. The following methods are evaluated in this report: ice bath of distilled water + distilled ice; ice bath of tap water + tap ice; and thermistors. In addition, the effects of using various Type SX extension leads between the thermocouple and the reference junction are evaluated. This was undertaken because all PML automated Thermocouple Calibration Systems show an offset at 0°C of between 0.2 and 0.6°C for Type S thermocouples. Justification for subtracting out this bias is the specific goal of this investigation.

38360 **Formation of virtual cathodes and microwave generation in relativistic electron beams.** Kwan, T.J.T.; Thode, L.E. (Advanced Concepts and Plasma Physics Group, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 7, 1570-1572(Jul 1984).

Simulation of the generation of a relativistic electron beam in a foil diode configuration and the subsequent intense microwave generation resulting from the formation of the virtual cathode is presented. The oscillating virtual cathode and the trapped beam electrons between the real and the virtual cathodes were found to generate microwaves at two distinct frequencies. Generation of high-power microwaves with about 10% efficiency might reasonably be expected from such a virtual-cathode configuration.

38361 **Programmable data-acquisition and stepping motor control system.** Whiting, D.; Williams, A. (California Institute of Technology, Pasadena, California 91125). *Review of Scientific Instruments;* **55**: No. 7, 1157-1159(Jul 1984).

The implementation of a compact, inexpensive, programmable stepping motor controller and data-acquisition system based on the Zilog Z-80 microprocessor is described, including its basic hardware and software configurations. While originally designed to facilitate data acquisition from scanning x-ray diffractometers, the units have proven to be quite versatile and have been applied to a variety of instrumentation requiring automatic data acquisition and mechanical control.

38362 **Analytically useful spectra excited in an atmospheric pressure active nitrogen afterglow.** Rice, G.W.; D'Silva, A.P.; Fassel, V.A. (Ames Laboratory and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Applied Spectroscopy;* **38**: No. 2, 149-154(Mar 1984).

An atmospheric pressure active nitrogen (APAN) discharge has been utilized for producing characteristic molecular emissions from nonmetallic species introduced into the afterglow region of the discharge. The addition of inorganic S-, P-, B-, Cl-, and Br-containing compounds into the afterglow has resulted in the formation of excited S_2, PN, BO, NCl, and NBr species, respectively. Intense molecular Br_2 emission and I_2 emission, as well as atomic I emission, have also been observed. Preliminary analytical utilization of the molecular or atomic emissions observed revealed that the APAN afterglow may serve as a potentially useful detector for the aforementioned elements.

38363 **Microchannel plate EUV detectors for the extreme ultraviolet explorer.** Siegmund, O.H.W.; Coburn, K.; Maling, R.F.; Wertheimer, D. (Space Sciences Lab., Univ. of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 776-779(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The design and operating characteristics of the prototype imaging microchannel plate (MCP) detector for the Extreme Ultraviolet Explorer (EUVE) Satellite are discussed. The authors show that this detector has achieved high position resolution performance (> 512X512 pixels) and has low (< 1%) image distortion. In addition, the channel plate scheme used has tight pulse height distributions (< 40% FWHM) for UV radiation and displays low (< .2 cnt cm^{-2} sec^{-1}) dark background counting rates. The authors also describe work that has been done on EUV filters in relation to the envisaged filter and photocathode complement.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 44040037173

38364 **Inter-pulse high-resolution gamma-ray spectra using a 14 MeV pulsed neutron generator.** Evans, L.G. (Computer Sciences Corp., Silver Spring, MD (USA)); Trombka, J.I. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center); Jensen, D.H.; Stephenson, W.A. (Sandia National Labs., Albuquerque, NM (USA)); Hoover, R.A. (Maryland Univ., College Park (USA)); Mikesell, J.L.; Tanner, A.B.; Senftle, F.E. (Geological Survey, Reston, VA (USA)). *Nuclear Instruments and Methods in Physics Research;* **219**: No. 1, 233-242(Jan-Feb 1984).

A neutron generator pulsed at 100 s^{-1} was suspended in an artificial borehole containing a 7.7 metric ton mixture of sand, aragonite, magnetite, sulfur, and salt. Two Ge(HP) gamma-ray detectors were used: one in a borehole sonde, and one at the outside wall of the sample tank opposite the neutron generator target. Gamma-ray spectra were collected by the outside detector during each of 10 discrete time windows during the 10 ms period following the onset of gamma-ray build-up after each neutron burst. The sample was measured first when dry and then when saturated with water. In the dry sample, gamma rays due to inelastic neutron scattering, neutron capture, and decay were counted during the first (150 μs) time window. Subsequently only capture and decay gamma rays dominated the spectrum during the period from 150 to 400 μs after the neutron burst in both samples, but decreased with time much more rapidly in the wet sample. A signal-to-noise-ratio (S/N) analysis indicates that optimum conditions for neutron capture analysis occurred in the 350-800 μs window. A poor S/N in the first 100-150 μs is due to a large background continuum during the first time interval. Time gating can be used to enhance gamma-ray spectra, depending on the nuclides in the target material and the reactions needed to produce them, and should improve the sensitivity of in situ well logging.

38365 **(LA-tr—84-9) Small size neutron tube UNG-1.** Bespalov, D.F.; Mints, A.Z.; Shkol'nikov, A.S. .Translated from *Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Yadernoi Geofiziki i Geokhimii ;* No. 1, 134-143(1968). Contract W-7405-ENG-36. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013346. DE84013346

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A tube UNG-1 (universal neutron gas-filled) is designed for the use in the well neutron generators IGN-1 and IGN-1-M (a pulse neutron generator). Their serial production in the USSR has been started in 1963. At the same year, the serial production of the tubes UNG-1 has been started. Thus, this tube is the first serial logging accelerating tube in the USSR. A Penning source, equipped with a hot cathode, was selected as an ion source of the tube.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 45010038150

38366 **(DGMK—248) Dispersion and ignition of hydrocarbon vapour clouds (status report).** Mueller, H.W. (Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)). May 1981. 93p. (In German). Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.).

With 110 refs., 21 tabs. and figs. in annex.

The present DGMK-Research Report describes the actual knowledge about dispersion and ignition of hydrocarbon vapour clouds to the best of authors knowledge. The time depending concentration contours - i.e. the boundary of upper resp. lower flamability limits - of the ignitable cloud have been described by more than 20 dispersion models. Which of these different models gives the best description of reality cannot definitely be stated, because up to the present comperative calculations have only been executed for a selection of partly obselete dispersion models. Results deviate in the order of magnitude of 1:33. Where as model calculations for stratified atmospheric cloud spreading (flue gas plumes) are giving satisfactory results, the conditions of propagation, mixing and interchange for heavy gas clouds are more complex and mathematical treatment is much more difficult. The kinetics of ignition of gas mixtures are very complex. Therefore model descriptions existing at present are only qualitative and comperative statements. After ignition one have to distinguish between deflagrations (flame velocity smaller than velocity of sound) and detonations (flame velocity higher then velocity of sound). Magnitude and effects of the pressure wave, which propagate ahead of the flame front, differ correspondently. According to the present knowledge it has to be assumed, that unconfined hydrocarbon clouds do not detonate but deflagrate under the normal conditions of a week ignition. Only a part of the cloud volume takes part in the reaction, this portion being 10-30% of the total cloud volume, depending of the model of release. According to various author's statements the efficiency of 1 kg hydrocarbon-air-mixture within the ignition limits corresponds to 1 kg TNT.

38367 **(LA—9961-T) Scale up of high explosive 5,7-dinitro-1-picrylbenzotriazole.** Sanchez, J.A. (Los Alamos National Lab., NM (USA)). Mar 1984. Contract W-7405-ENG-36. 106p. NTIS, PC A06; 3; GPO Dep. Order Number DE84015704.

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Improvements were made to the reaction that produces 5,7-dinitro-1-picrylbenzotriazole (BTX). The reaction was first improved on a ten-gram scale that increased the yield nearly threefold. The reaction was then scaled up to a fifty-gram scale in which all the improvements of the ten-gram research proved beneficial. The improvement to the reaction involved reducing reflux and heating time, substitution of isopropanol for ethanol and sodium bicarbonate for sodium acetate, production of picryl chloride from picric acid, introduction of water to aid in solubility and analysis of BTX both chemically and for explosives sensitivity. The cost of producing BTX after improving the reaction is one-fifth of what it was before study.

38368 **(LA—9973-MS) Eutectic explosives containing ammonium nitrate. Final report, October 1979-September 1981.** Stinecipher, M.M. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015705.

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Continued studies of the eutectic explosives of AN show that the most noticeable difference between eutectic systems is the size of the failure diameter. We report impact, thermal, and shock sensitivities for eutectic mixtures with various additives. Compat-

ibility of the eutectics with NQ is unusually good as shown by gas evolution on storage at elevated temperatures. Performance was determined with mixtures of AN/ADNT with NQ, Al, or EDD/KN. Also, the performances of two methods of preparing AN/EDD were compared. We measured the irreversible growth of pressed pellets in which 15% of the AN was replaced by KN. We determined the heat of fusion and the heat and products of detonation of AN/ADNT. In addition, the guanidine and ethylenediamine salts of dinitrotriazole were prepared and characterized.

38369 **(LA-UR—84-2038) Synthesis of new nitrotriazole derivatives.** Lee, K.Y. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 14p. (CONF-8405197—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014022.

From Synthesis of high energy materials meeting; Dover, NJ, USA (1 May 1984).

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Synthesis of 5,5'(1,1')-dinitro-3,3'-azo-1,2,4-triazole (DNAT) and 1(4),3-dinitro-1,2,4-triazole-5-one (DNTO) and their BKW performance calculations are discussed, as are various related compounds. (DLC)

38370 **(SAND—84-0764) Frequency selectivity of chemi-acoustic amplification in a constant volume gas.** Riley, M.E. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015056.

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The fact that chemical reactions can amplify disturbances suggests that the cellular structure of gaseous detonations is a result of frequency selective amplification of random initial fluctuations. Unfortunately, previous studies have shown a minimal frequency dependence in the chemi-acoustic growth rate. The calculations in this paper demonstrate that the amplification process is strongly frequency dependent in a uniform gas. These results encourage a new exploration of the perturbation-theoretic analysis of detonation waves.

4502 Nuclear

38371 **(AD-A—137990/8) French nuclear forces in the 1980s and 1990s. Professional paper.** Laird, R.F. (Center for Naval Analyses, Alexandria, VA (USA). Naval Studies Group). Aug 1983. 44p. (CNA-PP—400). NTIS, PC A03/MF A01.

The author concludes that the French are engaging in a significant nuclear modernization program. They are increasing the numbers of targets which can be covered on Soviet territory. The nature of targets covered on the European battlefield are changing as well. They are building a force structure potentially more in tune with West German interests and an extended deterrence capability. The Soviets are already noting these changes and it is to be hypothesized that their warfighting approaches and arms control policies will be increasingly affected by them. The French nuclear forces, thus, will become a more significant factor in Soviet calculations toward Europe in the next decade.

38372 **(AD-A—138285/2) Microstructure theory for three dimensional plasma transport. Technical report.** Prettie, C.W.; Chu, S.Y.F.; Workman, J.B. (Berkeley Research Associates, Inc., CA (USA)). 1 May 1983. 130p. NTIS, PC A07/MF A01.

Microstructure theory is a stochastic approach to plasma simulation which accounts for structures unresolved by sampling. A stochastic approach to plasma simulation is called for by the need to address a large range of plasma structure scale sizes in the simulation of high-altitude nuclear environments. The microstructure approach to a 2-dimensional split-step numerical simulation of electrostatic plasma evolution is presented with comparison to the classical split-step approach. The primary difference between the two approaches rests in the assumed dependence of the plasma conductivity upon plasma density statistics. Justification for the microstructure conductivity assumption from numerical experiments is presented. Numerical simulations of barium-like plasma clouds and nuclear clouds under the influence of radial winds are presented which illustrate physically realistic results. Numerical considerations are also discussed. In extensions of microstructure theory from 2-dimensional plasma evolution to 3-dimensional transverse transport the nature of the correlation of plasma structure along magnetic field lines is a key consideration. For the case of complete correlation, i.e., correlation with a correlation coefficient of plus or minus 1, three-dimensional algorithms are developed and implemented in a version of SCENARIO. The algorithms are physically appealing in form, reflecting many of the expected attributes of gradient-drift phenomena. The results of a Cheyenne Mt. calculation are given.

38373 **(AD-A—138287/8) Shot HOOD: a test of the PLUMBBOB series, revised. Technical report.** Maag, C.; Wilkinson, M.; Striegel, J.; Collins, B. (JRB Associates, Inc., McLean, VA (USA)). 13 May 1983. 110p. NTIS, PC A06/MF A01.

Supersedes report dated 27 Feb 81, AD-A101073.

This report describes the activities of DoD personnel, both military and civilian, in Shot HOOD, the sixth nuclear test in the PLUMBBOB atmospheric weapons testing series. The test was conducted on 5 July 1957 and involved participants from Exercise Desert Rock VII, AFSWP, AFSWC, and AEC test groups. This volume also describes the radiological safety criteria and procedures in effect at Shot HOOD. At the time of the first edition of SHOT HOOD, the after-action report describing the Marine brigade exercise (Provisional Atomic Exercise Brigade, Report of Exercise Desert Rock VII, Marine Corps) had not been located. For this edition, the after-action report has been used to corroborate, to correct, and to supplement accounts of the troop exercise drawn from planning documents and interviews. This has resulted in substantial revision of section 2.2.

38374 **(AD-A—138288/6) SPIRE data evaluation and nuclear ir fluorescence processes. Final report 2 Jan 79-30 Nov 82.** Kumer, J.B.; James, T.C. (Lockheed Missiles and Space Co., Sunnyvale, CA (USA)). 30 Nov 1982. 118p. (LMSC-D—913086). NTIS, PC A06/MF A01.

This report focuses on two major subject areas. The first of these includes the analysis and interpretation of spectral earthlimb emission data obtained in the DNA sponsored SPIRE experiment, and the implications of this analysis for application to cases of interest to the AFGL/DNA community. These would include quantitative specification of ambient non-LTE mechanisms for high altitude infrared radiance, which would also become important infrared background effects in the nuclear case, as well as quantitative identification of deficiencies in the current AFGL High Altitude Infrared Radiance Model. The second subject area involves a supporting laboratory experiment to obtain data pertinent to understanding the nuclear effects of fluorescence of fireball light. The laboratory experiment also directly supports the analysis and interpretation of the SPIRE data and the interpretation and analysis of high resolution spectral earthlimb emission data that are expected to be obtained in forthcoming DNA sponsored high resolution spectral earthlimb emission experiments. Analysis and interpretation of spectral earthlimb emission data obtained in the SPIRE experiment was aimed at quantifying the role of CO 2 in the formation of the non-LTE earthlimb at wavelengths 15, 4.3 and 2.7 microns. Non-LTE mechanisms for CO 2 emission in these wavelength regions were verified and in some cases upgraded by comparison between predictions and the SPIRE data.

38375 **(AD-A—140281/7) Fragment hazards on Pre-DIRECT COURSE. Final report Jan 82-Mar 83.** Guice, R.L. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Jan 1984. 264p. NTIS, PC A12/MF A01.

A height-of-burst (HOB) test such as Pre-DIRECT COURSE creates many areas of interest. To obtain a known HOB experiment with a high-explosive charge some type of support structure is required. This support structure may cause hazards from fragments. Given a certain set of initial conditions, a fragment could be capable of traveling tens of thousands of meters. Many locations in the test area require that personnel be present, operating equipment or conducting the test (i.e., instrumentation vans, administration vans, laser bunker, weather station, and observation area).

The possible presence of fragments creates safety hazards and individual experiment hazards. Possibilities will exist for gages or objects to receive damage from fragment impact. This effort attempts to predict the quantity, velocity, and range of fragments present. An effort was made to predict, identify and measure fragments and their trajectories for the Pre-DIRECT COURSE event. A method does not exist which will perform the task by itself. Various predictive techniques exist from other work areas which, with care, can be applied to the case of interest. The predictive analysis as derived by Bishop results in the best prediction. Impact probabilities from Pre-DIRECT COURSE reveal that a person must be located out of a 130.3 m radius from ground zero to meet a safety criteria of less than one impact in one million. The factor of increase in fragment trajectories from Pre-DIRECT COURSE to DIRECT COURSE is calculated to be 1.0687.

38376 **(CONF-840614—80) Adjoint transport calculations for sensitivity analysis of the Hiroshima air-over-ground environment.** Broadhead, B.L.; Cacuci, D.G.; Pace, J.V. III. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014289.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

A major effort within the US Dose Reassessment Program is aimed at recalculating the transport of initial nuclear radiation in an air-over-ground environment. This paper is the first report of results from adjoint calculations in the Hiroshima air-over-ground environment. The calculations use a Hiroshima/Nagasaki multi-element ground, ENDF/B-V nuclear data, one-dimensional ANISN flux weighting for neutron and gamma cross sections, a source obtained by two-dimensional hydrodynamic and three-dimensional transport calculations, and best-estimate atmospheric conditions from Japanese sources. 7 references, 2 figures.

38377 **(SAND—83-1495) Model to predict the melting and ablation of reactive metal shrapnel in a high Weber number environment.** Connell, L.W. (Sandia National Labs., Albuquerque, NM (USA)). May 1984. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015002.

Aerothermoballistic behavior of pyrophoric metal shrapnel ejected at supersonic speeds has been numerically simulated. The theoretical model predicts aerodynamic and chemical heat-transfer rates and particle thermal response, including time and position of melt initiation. Because of the high Weber number environment, the melting particle undergoes liquid layer stripping. The model, incorporated in the PLUTO computer code, predicts the liquid mass loss rate, characteristic liquid droplet diameter, temperature rise across the liquid film, and the coupled particle trajectory. The aeroheating, thermal, and ballistic sections of the PLUTO code have been validated by comparison with independent calculations and qualitative experimental data concerning the melting and ablation of gold microspheres. The model still needs to be field tested against reactive metal particles in high Weber number flows.

38378 **Effects on agriculture.** Bondietti, E.A. (Oak Ridge National Laboratory, TN). *Ambio;* **11**: No. 2-3, 138-142(1982).

A global nuclear war will cause radioactive contamination of man's diet, disruptions in food production and distribution, and food shortages. Beyond regions that are directly affected by local fallout from specific detonations, radioactivity levels in diet and human tissues will be about 20 times higher than during the weapons' testing period of the 1960's. Food produced in areas contaminated by local fallout from surface detonations, but more than about 150 km away from targets, will also derive most of its contamination from global fallout. The presence of global fallout and the disruption in technological and food aid to the Third World will ensure that the impacts of the war will extend beyond those countries directly involved.

4503 Explosion Detection

38379 **(AD-A—140922/6) Algorithmic design of a classification system for at-sea nuclear detonations. Final report.** Young, D.F.; McQuitty, J.B.; Weinstein, M.S. (Underwater Systems, Inc., Rockville, MD (USA)). 3 Apr 1984. 7p. NTIS, PC A02/MF A01.

This document presents an algorithmic design of a system for the hydroacoustic detection, localization and classification of a suspected at-sea nuclear detonation. Based on basic acoustic principles and nuclear blast theory, the system provides an estimate of the yield-vs-depth/altitude curve for a remote suspect event based on the hydroacoustic signal received at a deep-ocean hydrophone. It is the conclusion of the authors that this system can provide a high-confidence determination of whether or not a suspect atmospheric event is nuclear in origin. A much lower level of confidence is placed on the determination of the yield-vs-altitude curve for such as event. The cumulative effect of error in signal measurement, error in acoustic predictions required by the system, and possible inherent inaccuracies in the method used determining yield vs altitude could result in order-of-magnitude error in yield/altitude determinations. Nevertheless, its implementation would provide a valuable adjunct to the present nuclear monitoring system. In addition to the development of system-specific software, implementation of the classification program will require extant propagation loss models, environmental data banks and localization algorithms, all of which currently reside at the Naval Ocean Research and Development Activity (NORDA). It is recommended that the system be implemented on the NORDA computer and that NORDA be designated the responsible activity for its operation.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

38380 **(N—8330016) Controlled Ecological Life Support System. First Principal Investigators Meeting.** Moore, B., III; Wharton, R.A. Jr.; Macelroy, R.D. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Dec 1982. 90p. (NASA-CP—2247; A—9055; CONF-8105252—). NTIS, PC A05/MF A01.

From 1. meeting on controlled ecological life support system; Durham, NH, USA (3 May 1981).

Control problems in autonomous life support systems, CELSS candidate species, maximum grain yield, plant growth, waste management, air pollution, and mineral separation are discussed. For individual titles, see N83-30017 through N83-30033.

38381 **(PNL—5141) Alpine meteorology: translations of classic contributions by A. Wagner, E. Ekhart, and F. Defant.** Whiteman, C.D.; Dreiseitl, E. (eds.). (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 129p. (ASCOT—84-3). NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84014929.

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The English translations of four classic research papers in Alpine meteorology, originally published in German and French in the 1930s and 1940s are presented in this report. The papers include: A. Wagner's 1938 paper entitled Theory and Observation of Periodic Mountain Winds; E. Ekhart's 1944 paper entitled Contributions to Alpine Meteorology; E. Ekhart's 1948 paper entitled On the Thermal Structure of the Mountain Atmosphere; and F. Defant's 1949 paper entitled A Theory of Slope Winds, Along with Remarks on the Theory of Mountain Winds and Valley Winds. A short introduction to these translations summarizes four recent Alpine meteorology field experients, emphasizing ongoing research that extends the research of Wagner, Ekhart, and Defant. The four experiments include the Innsbruck Slope Wind Experiment of 1978, the MESOKLIP Experiment of 1979, the DISKUS Experiment of 1980, and the ALPEX/MERKUR Experiment of 1982.

38382 **(PNL—5163) Green River air quality model development: meteorological and tracer data, July/August 1982 field study in Brush Valley, Colorado.** Whiteman, C.D.; Lee, R.N.; Orgill, M.M.; Zak, B.D. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 157p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84014975.

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Meteorological and atmospheric tracer studies were conducted during a 3-week period in July and August of 1982 in the Brush Creek Valley of northwestern Colorado. The objective of the field experiments was to obtain data to evaluate a model, called VALMET, developed at PNL to predict dispersion of air pollutants released from an elevated stack located within a deep mountain valley in the post-sunrise temperature inversion breakup period. Three tracer experiments were conducted in the valley during the 2-week period. In these experiments, sulfur hexafluoride (SF_6) was released from a height of approximately 100 m, beginning before sunrise and continuing until the nocturnal down-valley winds reversed several hours after sunrise. Dispersion of the sulfur hexafluoride after release was evaluated by measuring SF_6 concentrations in ambient air samples taken from sampling devices operated within the valley up to about 8 km down valley from the source. An instrumented research aircraft was also used to measure concentrations in and above the valley. Tracer samples were collected using a network of radio-controlled bag sampling stations, two manually operated gas chromatographs, a continuous SF_6 monitor, and a vertical SF_6 profiler. In addition, basic meteorological data were collected during the tracer experiments. Frequent profiles of vertical wind and temperature structure were obtained with tethered balloons operated at the release site and at a site 7.7 km down the valley from the release site. 10 references, 63 figures, 50 tables.

38383 **Short-term climatic fluctuations forced by thermal anomalies.** Hanna, A.F.; Stevens, D.E.; Reiter, E.R. (Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523). *Journal of the Atmospheric Sciences;* **41**: No. 1, 122-141(1 Jan 1984). Contract AC02-76EV01340.

A two-level, global, spectral model is used to study the response of the atmosphere to sea surface temperature anomalies. Two sea surface temperature anomaly patterns are investigated. The first, called the El Nino pattern (Experiment 1), represents a warm anomaly in the equatorial Pacific, whereas the second pattern (Experiment 2) represents coupled midlatitude (cold/equatorial (warm) sea surface temperature anomalies in the Pacific Ocean. The results demonstrate that both of these sea surface temperature anomaly patterns produce statistically significant midtropospheric geopotential responses in middle latitudes. However, the geopotential response forced by the coupled sea surface temperature anomaly is qualitatively more similar to the geopotential height pattern which is observed in association with the negative phase of the Southern Oscillation (Horel and Wallace). Analysis of the differences (anomaly minus control) of the meridional transports of momentum, sensible heat and latent heat indicates that the coupled pattern tends to largely enhance the northward transports of momentum and sensible heat, especially for the transient and stationary eddy components. The maximum difference in the total (transient, stationary eddies and mean meridional circulation) transports of momentum is nearly double that revealed by the El Nino experiment.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 50020037117, 37123, 37168, 37169, 37292, 37529, 38417, 38449, 38450, 38454, 38554

38384 **(AD-A—140190/0) Landfill gas control at military installations. Final report.** Shafer, R.A.; Renta-Babb, A.; Bandy, J.T.; Smith, E.D.; Malone, P. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Jan 1984. 46p. (CERL-TR-N—173). NTIS, PC A03/MF A01.

This report provides information useful to Army personnel responsible for recognizing and solving potential problems from gas generated by landfills. Information is provided on recognizing and gauging the magnitude of landfill gas problems; selecting appropriate gas control strategies, procedures, and equipment; use of computer modeling to predict gas production and migration and the success of gas control devices; and safety considerations.

38385 **(DOE/ER/60079—T6) Response of arctic ecosystems to elevated carbon dioxide regimes. Progress report, 1 July 1984-30 June 1986. Volume II.** Oechel, W.C. (San Diego State Univ., CA (USA). Systems Ecology Research Group). 1984. Contract AC03-82ER60079. 260p. NTIS MF A01; 2; GPO Dep. Order Number DE84015236.

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The goal of the project is to establish the effects of medium- and long-term field manipulations of CO_2 in northern ecosystems so that total system interactions can be evaluated and the effect of elevated CO_2 levels on carbon accumulation and species composition determined. This volume contains the results of a workshop on the measurement and modeling of the effects of elevated atmospheric CO_2 on natural ecosystems, and progress in studies of the response of arctic ecosystems to elevated carbon dioxide regimes. (ACR)

38386 **(DOE/EV/10403—13) Resolution of source contributions to environmental samples. Technical progress report, July 1, 1983-June 30, 1984.** Hopke, P.K. (Illinois Univ., Urbana (USA). Inst. for Environmental Studies). Jul 1984. Contract AC02-80EV10403. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014827.

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The application of linear programming to solving aerosol mass source apportionment has been explored. The prior mass balance methods have used least-squares methods for obtaining estimates of the source contributions. Given the heavy-tail distributions typical of ambient particulate elemental concentrations and the collinearities in the input source composition matrix, least-squares may not be the appropriate mathematical approach. In this report the problem has been reformulated to fit several forms necessary for linear programming and these alternative approaches have been evaluated using both simulated and real aerosol composition data sets. The linear programming approach yields better fits to the data and more closely estimates the actual values for the simulated data. Suggestions for future directions in this area are described. 37 references, 10 tables.

38387 **(DOE/MC/19285—1505-Vol.1) Analysis of potential combustion source impacts on acid deposition using an independently derived inventory. Volume I.** (PEDCo-Environmental, Inc., Cincinnati, OH (USA); Spaite (Paul W.) Co., Cincinnati, OH (USA)). Dec 1983. Contract AC21-82MC19285. 224p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84012005.

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This project had three major objectives. The first objective was to develop a fossil fuel combustion source inventory (NO/sub x/, SO/sub x/, and hydrocarbon emissions) that would be relatively easy to use and update for analyzing the impact of combustion emissions on acid deposition in the eastern United States. The second objective of the project was to use the inventory data as a basis for selection of a number of areas that, by virtue of their importance in the acid rain issue, could be further studied to assess the impact of local and intraregional combustion sources. The third objective was to conduct an analysis of wet deposition monitoring data in the areas under study, along with pertinent physical characteristics, meteorological conditions, and emission patterns of these areas, to investigate probable relationships between local and intraregional combustion sources and the deposition of acidic material. The combustion source emissions inventory has been developed for the eastern United States. It characterizes all important area sources and point sources on a county-by-county basis. Its design provides flexibility and simplicity and makes it uniquely useful in overall analysis of emission patterns in the eastern United States. Three regions with basically different emission patterns have been identified and characterized. The statistical analysis of wet deposition monitoring data in conjunction with emission patterns, wind direction, and topography has produced consistent results for each study area and has demonstrated that the wet deposition in each area reflects

the characteristics of the localized area around the monitoring sites (typically 50 to 150 miles). 8 references, 28 figures, 39 tables.

38388 **(Juel—1877) Study on the effects of carbon dioxide emissions on the climate.** Volz, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Atmosphaerische Chemie). Nov 1983. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84751941.

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In regard to the potential hazard posed by CO_2, the necessity has to be emphasised to use fossil energy carriers as economically and effectively as possible. Along with a promotion of the possible methods and means of utilizing energy more effectively, development of resilient-energy systems - i.e. adaptable ones - is a must which will allow introducing technological innovations for coal substitution etc. as rapid and as low in cost expeditures as possible. One thing is clear: it will take decades to phase out a capacity installed once and oriented exclusively to fossil fuels. Searching for alternative approaches and initiating them will be too late if started only after CO_2 has been established and acknowledged beyond doubt as a threat to the climate. The initial considerations shown in this article will have to be followed by intensive studies on the effects of the total system on environment along with detailed cost-benefit analyses.

38389 **(LA—9445-PNTX-G) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: estimated releases and downwind concentrations of air pollutants from waste organic solvent evaporation, waste high-explosive burning, and high-explosive test shots.** Macdonell, D.G.; Dewart, J.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008066.

This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's (DOE) Pantex Plant near Amarillo, Texas. Specifically, this report discusses the following operations at the Pantex Plant that routinely emit air pollutants: evaporation of waste organic solvents contaminated with high explosives, burning of waste high explosives, and high-explosive test shots. Available experimental data and published emission factors were used to estimate the amounts of pollutants released into the atmosphere from each source. Pollutant concentrations were calculated at the main plant area and at the site boundary under both typical and unfavorable meteorological dispersion assumptions using Gaussian plume and puff models. These concentration estimates were then compared to existing air quality standards, occupational exposure limits, and, where no standards exist, to toxicological data.

38390 **(PB—84-170042) Protocol for the collection and analysis of volatile POHCS (principal organic hazardous constituents) using VOST (Volatile Organic Sampling Train). Final report Apr 83-Feb 84.** Hansen, E.M. (Envirodyne Engineers, Inc., St. Louis, MO (USA)). Mar 1984. 61p. NTIS, PC A04/MF A01.

The document is a state-of-the-art operating protocol for sampling and analysis of volatile organic constituents of flue gas from hazardous waste incinerators or other similar combustor systems using the Volatile Organic Sampling Train (VOST). It is intended to be used for guidance by personnel of the regulatory groups, personnel associated with engineering research and development, and the regulated community. The document is in two parts. Part A describes the key components of the train, the procedures for preparing the sorbent materials, and procedures for sample collection using the VOST. Part B describes the procedures for analyzing VOST sorbent cartridges for volatile principal organic hazardous constituents (POHCs) using purge-trap-desorb gas chromatography/mass spectrometry (P-T-D GC/MS). Quality control procedures are presented in both parts.

38391 **(PB—84-182823) Miniature acid condensation system: design and operation.** Cheney, J.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Apr 1984. 72p. (EPA—600/3-84-056). NTIS, PC A04/MF A01.

An extractive source sampling system was designed and constructed. The sampling system measures gaseous sulfuric acid and sulfur dioxide in combustion emissions. The miniature acid condensation system (MACS) includes a high-temperature quartz probe and quartz-filter holder. Since there is no commercially-available manual sampling system for measuring gaseous sulfuric acid at the present time, a prototype sampling system must be constructed for making such measurements. The purpose of this work is to provide a guideline for building such a sampling system. Also included is a discussion of two sulfate analytical methods, Barium-Thorin and Ion Chromotography. In addition, a brief discussion of sulfate analyses data handling and the results of some source emissions sampling are presented.

38392 **(PB—84-185628) Engineering development of a clean burning residential wood stove.** Knoke, G.S.; Malte, P.C.; Butler, G.W. (Flow Research, Inc., Kent, WA (USA)). Apr 1982. 78p. NTIS, PC A05/MF A01.

Results are presented of a survey undertaken to assess the basic problems of residential wood stoves and the design approaches for the development of a clean wood-burning stove. It is determined that mean combustion temperatures approaching 1000C are needed, and that well-mixed, well-aerated flames are essential for low emissions. Also, controlled pyrolysis hot char-volatiles interaction, and controlled air flow are important considerations for clean burning of sticks and logs. The development of a mathematical and computational model of the residential wood stove based upon gasification, pyrolysis, combustion, fluid dynamic, and heat transfer processes in the stove is discussed. It is determined that a modular stove for laboratory testing and prototype design is feasible.

38393 **(PB—84-187806) Feasibility study for adapting present combustion source continuous monitoring systems to hazardous waste incinerators. Volume 2. Review and estimation of incineration test conditions. Final report Oct 81-Sep 82.** McInnes, R.; Peduto, E.; Podlenski, J.; Abell, F.; Gronberg, S. (GCA Corp., Bedford, MA (USA)). Mar 1984. 78p. (GCA-TR—82-60-G(2)). NTIS, PC A05/MF A01.

See also PB84-187814.

The report gives results of an adaptability study of commercially available sample conditioning and measurement systems, in the form of a guidelines document to be used by EPA and industry personnel. As part of EPA-sponsored research programs to investigate sampling and analysis methods for hazardous waste incineration (focused on adapting existing methods for identifying and quantifying constituents listed in 40 CFR 261), the adaptability of existing continuous emission monitoring systems (CEMS) involves such measurement categories as SO2, SO3, NOx, CO, CO2, O2, HCl, and organic materials. Study results indicate that commercially available extractive continuous monitors can be adapted to incinerators through proper sample conditioning. Available CEMS provide the ranges and sensitivities needed to accurately measure concentrations of the organic and inorganic components of interest.

38394 **(PB—84-189257) Intermediate-range grid model and user's guide for atmospheric sulfur dioxide and sulfate concentrations and depositions - Wisconsin Power Plant impact study.** Wilkening, K.E.; Ragland, K.W. (Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering). May 1984. 114p. NTIS, PC A06/MF A01.

Prepared in cooperation with Wisconsin Public Service Corp., Green Bay, Wisconsin Public Service Commission, Madison, and Wisconsin Dept. of Natural Resources, Madison.

The UWATM-SOX computer model was developed to address the acid rain problem on a mesoscale. It predicts sulfur dioxide (SO2) and sulfate (SO4) ambient air concentrations and ground level dry and wet (rain or snow) depositions given certain emission and meteorological input data. It is a time-dependent, cell-type model which numerically solves coupled SO2 and SO4 conservation and mass equations described in an exterior frame of reference for a dilute species in the atmospheric boundary layer. Significant features of the model include: Handling arbitrary wind directions; inputting hourly meteorological data; fully computerized processing of meteorological tapes obtained from the National Climate Center; simultaneous handling of point, line, and area sources; accounting for the lofting condition of point source plumes; describing the at-

mospheric boundary layer by vertically variable but horizontally uniform wind and diffusivity profiles; handling dry deposition by means of a deposition velocity which accounts for terrain and net condition; and handling wet deposition by means of a non-linear cold cloud precipitation model developed by Battelle Pacific Northwest Labs. The model is written in ASCII Fortran and has been applied to the Rainy Lake Watershed in northern Minnesota and southern Ontario. A 1-yr simulation with an 11 x 13 x 6 cell structure and hourly meteorological data changes required 50K core space and took 6 h of computer up (CPU) time.

38395 **(PB—84-198480) Development of advanced residential cooktop burner with low NOx emissions. Annual report on phase 1, Feb 82-Oct 83.** DeWerth, D.W.; Sterbik, W.G. (American Gas Association Labs., Cleveland, OH). Nov 1983. 108p. NTIS, PC A06/MF A01.

See also PB83-228338.

This report describes the result of work completed during February, 1982 to October 1983. The aim of the work was to develop a low NO(x) emission range top burner. Discussed is the development of a flame insert modification to an existing burner which reduces NO(x) emission by 45 percent and NO2 emission by 25 percent. This relatively simple burner add-on device appears to be an economically viable low NO(x) burner. It was developed in cooperation with a major range manufacturer. The levels of NO(x) (NO2) reduction achieved should significantly reduce the impact of a gas range to indoor quality. The report also discusses the results of a literature search that preceeded the burner development. The search helped to direct the burner development by reviewing the state-of-the-art of low NO(x) burner design and covered factors which affect the indoor impact of range emissions such as air infiltration and ventilation trends, air quality standards, and NO(x) (NO2) health affect studies.

38396 **(TVA/PUB—84/58) How clean is our air: an update. Air quality in the Tennessee Valley.** Parkhurst, W.J.; Barnard, B.L.; Manning, J.A. (Tennessee Valley Authority, Muscle Shoals, AL (USA)). 1984. 27p. NTIS, PC A03/MF A01. Order Number DE84901613.

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This booklet is based on recent air quality and emissions information collected by federal, state, and local regulatory agencies and the Tennessee Valley Authority. It discusses the sources and effects of the pollutants that have historically been of concern and indicates areas of continuing concern. It also considers (emerging air quality concerns, such as acid rain, hazardous pollutants, inhalable particulates, indoor air pollution, and visibility impairment) which will help to shape the future of the environment.

38397 **(UCID—20128) Future scenarios and ozone change.** Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1984. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014781.

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The effect of future scenarios for emissions of chlorocarbons, CO_2, CH_4, N_2O and NO/sub x/ were calculated with the LLNL 1-D model. Several chlorocarbon scenarios were examined. For CO_2, the scenario used is based on the NRC analysis, with CO_2 assumed to reach 770 ppMv by 2100. For CH_4 and N_2O, concentrations are assumed to increase 0.5%/yr and 0.2%/yr, respectively, based on recent measured trends. The NO/sub x/ emissions are based on presently available estimates of aircraft emissions until 1990 NO/sub x/ emissions are assumed unchanged after 1990. Model calculations which include the effect of chlorocarbon emissions of the ClCs at 1982 levels, gives a steady state ozone change of -4.6% including temperature feedback effects. When the effect of other trace gases known to have presently increasing concentrations (CO_2, CH_4, N_2O, NO/sub x/) are included in scenario A, a small increase in total ozone is calculated for the next 70 years. However, significant decreases in total ozone could result if chlorocarbon emissions were to increase by as much as 3%/yr. Declining chlorocarbon emissions (3%/yr) would add slightly to the increases in total ozone. 4 figures.

38398 **Influence of volatility on the collection of polycyclic aromatic hydrocarbon vapors with polyurethane foam.** You, F.; Bidleman, T.F. (Shanxi Medical College, Taiyuan). *Environmental Science and Technology;* **18**: No. 5, 330-333(May 1984).

Polycyclic aromatic hydrocarbon (PAH) vapor penetration through thin sections of polyurethane foam (PUF) was studied to determine the relationships between sample breakthrough, PAH vapor pressure, and total air volume. Frontal chromatographic movement of fluorene, phenanthrene, anthracene, and pyrene vapors through a PUF bed at high volume airflow was examined. From these fronts, the thickness of foam corresponding to 50% breakthrough was obtained for each compound. This breakthrough point was related to total air volume, and breakthrough point was related to total air volume, and breakthrough volumes (V/sub B/) were determined for a 7.5-cm PUF thickness (equivalent to a single field sampling plug). A log-log plot of V/sub B/ vs. PAH solid phase vapor pressure showed only a rough relationship between the two parameters, but the correlation was much improved when the subcooled liquid vapor pressure was used. From the frontal chromatograms the number of theoretical plates (N) in the absorbent bed was determined. When V/sub B/ and N were known, the maximum safe sampling volume at a required collection efficiency was calculated. 25 references.

38399 **Determination of polycyclic aromatic hydrocarbons in biomass gasifier effluents with liquid chromatography/diode array spectroscopy.** Desilets, D.J.; Kissinger, P.T.; Lytle, F.E.; Horne, M.A.; Ludwiczak, M.S.; Jacko, R.B. (Purdue Univ, West Lafayette, IN). *Environmental Science and Technology;* **18**: No. 5, 386-391(May 1984).

Liquid chromatography/diode array spectroscopy (LC/DAS) is used for the determination of polycyclic aromatic hydrocarbons (PAH) isolated from the emissions of biomass gasifiers. The spectrometer is capable of obtaining complete absorption spectra of components as they elute from the chromatograph, thus confirming the identities for pure peaks and mixed or poorly resolved peaks. This technique is especially well suited for the determination of polynuclear aromatics, where many isomers difficult to resolve chromatographically are easily distinguished by their electronic spectra. The instrument is also capable of differentiating between unsubstituted PAH and their methylated analogues, even though methylation does not greatly perturb the electronic nature of the parent hydrocarbon. 22 references.

38400 **Acidic and related constituents in liquid water stratiform clouds.** Daum, P.H.; Schwartz, S.E.; Newman, L. (Environmental Chemistry Division, Department of Applied Science, Brookhaven National Laboratory). *Journal of Geophysical Research;* **89**: No. D1, 1447-1458(20 Feb 1984).

Composition of cloud liquid water and interstitial air is reported for aircraft measurements near Charleston, South Carolina, in February 1982. Cloud water was collected by means of a slotted-rod impactor. Cloud-free interstitial air was obtained by a centrifugal separator. Principal ionic species in cloudwater were H^+, SO_4^-, NO_3^-, and NH_4^+. The relative acidity of cloudwater, as measured by the ratio of H^+ to NH_4^+, was much greater than that of the interstitial aerosol or of clear-air aerosol samples. Gaseous O_3, NO_3 (i.e., $NO+NO_2$), and SO_2 were present in interstitial air within clouds, whereas HNO_3 an NH_3 were below limit of detection (0.4 ppb for both species). Comparision of relative acidity of cloudwater samples with that of clear-air samples suggests that clear-air aerosol and HNO_3 are incapable of providing the levels of acidity observed in cloudwater. Such acidity would be consistent with in-cloud conversion of prevailing concentrations of SO_2 or SO_2+NO_4 to aqueous strong acid, although other hypotheses cannot be excluded. Comparison of absolute concentrations of cloudwater constituents to concentration in clear-air measurements gives no indication of accumulation of sulfur and nitrogen species by clouds.

38401 **Atmospheric transport models for complex terrain.** Davis, C.G.; Bunker, S.S.; Mutschlecner, J.P. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Meteorology;* **23**: No. 2, 235-238(Feb 1984).

Two codes, ATMOS1 and ATMOS2, have been developed to model respectively, wind fields and pollutant transport in three dimensions with particular application to complex terrain. ATMOS1 models wind fields with the use of a mass conservation error minimization principle employing available observations. ATMOS2 employs these wind fields to model transport by advection and diffusion using a Crowley second-order flux extimation. Both codes employ terrain-following vertical coordinates which provide critical resolution of the boundary layer and simplify boundary conditions at the surface. A companion paper provides examples of models produced by the codes with comparison to observation.

38402 **Application of atmospheric transport models for complex terrain.** King, D.S.; Bunker, S.S. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Meteorology;* **23**: No. 2, 239-342(Feb 1984).

Numerical modeling techniques are applied to several diverse situations to study mesoscale transport of effluents in the earth's atmosphere. Simulations of a tracer release in complex terrain are compared with experiments carried out in the Northern California Geysers area during a period when nighttime drainage flow was the dominant feature. In addition, we study two situations, the Idaho National Engineering Laboratory and the Savannah River Laboratory, for which the terrain is assumed to not be a factor. These involve large modeling areas and in one case, time periods extending over more than two diurnal cycles. These model simulations indicate that a diagnostic wind model utilizing terrain-following coordinates gives reasonable agreement with observations obtained over simple as well as complex terrain. In order to increase the accuracy in simulations of pollutant concentration distribution, much more refinement in wind measurements in space and time is needed since small differences in wind direction, for example, can produce a large difference in computed and measured concentration sufficiently downwind of a source.

38403 **Contribution of nitropyrene to the mutagenic activity of coal fly ash.** Harris, W.R.; Chess, E.K.; Okamoto, D.; Remsen, J.F.; Later, D.W. (Univ. of California, Davis). *Environmental Mutagenesis;* **6**: No. 2, 131-144(1984). Contract AC03-76SF00472.

Stack-collected coal fly ash from western low-sulfur coal was extracted with 60:40 benzene/methanol. This extract was fractionated by preparative-scale high performance liquid chromatography (HPLC) and the mutagenic activity of 14 fractions was evaluated by microbial assay with Salmonella typhimuruim TA1538. A widespread distribution of direct-acting mutagens, which probably includes both mono- and di-nitroaromatics, was detected.

38404 **Molecular beam study of weakly bound bimolecular complexes containing SO_2.** DeLeon, R.L.; Muenter, J.S. (Univ. of Rochester, NY). *Atmospheric Environment;* **18**: No. 5, 995-999(1984). Contract AC02-77EV04321.

The potential importance of bimolecular complexes in atmospheric processes is reviewed. Many observations suggest weakly bound species play significant roles in the atmosphere. Since the lack of binding energy data for such clusters makes definite conclusions difficult, experimental studies of the interaction of SO_2 with 18 different molecular binding partners was carried out. The relative binding energy of these complexes was estimated by observing how effectively a given cluster competed with the formation of other weakly bound species in a supersonic molecular beam source. Trends, and possible explanations for such trends, are discussed.

38405 **Acid rain information book.** Bubenick, D.V. (ed.). Park Ridge, NJ; Noyes Publications (1984). 412p. (DOE/NBM—4014917). Noyes Publication, Mill Road, Park Ridge, New Jersey 07656. Order Number TI84014917.

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The potential consequences of widespread acid precipitation demand that this phenomenon be carefully evaluated. Review of the literature shows a rapidly growing body of knowledge, but also reveals major gaps in understanding that need to be narrowed. This document discusses major aspects of the acid rain phenomenon, points out areas of uncertainty, and summarizes current and projected research by responsible government agencies and other concerned organizations. It follows the logical progression from sources of pollutants affecting acid rain formation to the atmospheric transport and transformation of those pollutants and finally to the deposition of acid rain, the effects of that deposition, and possible mitigative measures. This information is followed by a discussion of uncertainties in the understanding of the acid rain phenomenon and a description of current and proposed research.

38406 **Washout coefficients for polydisperse aerosols.** Dana, M.T.; Hales, J.M. (Battelle Pacific Northwest Lab., Richland, WA). *ERDA Symposium Series;* **41**: 247-257(1974).

When considering the washout properties of polydisperse aerosols, we must specify whether the washout is in terms of number of aerosol particles or in terms of length, area, or mass of aerosol. This follows from the fact that the washout coefficient is a function of an appropriate moment of the particle size distribution function used. Sample calculations, using collection efficiencies that cover the particle radius range $0.001 < a < 10\mu m$ and log-normal raindrop and particle size spectra, show that the washout coefficient for polydisperse aerosol is generally larger than it would be for a monodisperse aerosol of radius equal to some typically used distribution parameter. This result shows that it is difficult, if not practically impossible, to deduce generalized washout properties of aerosols. 12 references, 5 figures, 3 tables.

38407 **Washout of SO_2 from the plume of a coal-fired power plant.** Hales, J.M.; Thorp, J.M.; Wolf, M.A. (Battelle Pacific Northwest Lab., Richland, WA). *ERDA Symposium Series;* **41**: 293-303(1974).

Recent field measurements of washout by rain and snow of SO_2 in plumes from the 800-ft stacks at the world's largest mine-mouth electric power generating plant demonstrate some complexities arising from the interaction of meteorological and physicochemical factors. 5 references, 8 figures.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5003037272, 37292, 37347

38408 **(CONF-840614—75) Estimating radionuclide air concentrations near buildings: a screening approach.** Miller, C.W.; Yildiran, M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014261.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

For some facilities that routinely release small amounts of radionuclides to the atmosphere, such as hospitals, research laboratories, contaminated clothing laundries, and others, it is necessary to estimate the dose to persons very near the buildings from which the releases occur. Such facilities need simple screening procedures which provide reasonable assurance that as long as the calculated dose is less than some fraction of a relevant dose limit no individual will receive a dose in excess of that limit. Screening procedures have been proposed for persons living within hundreds of meters to a few kilometers from a source of radioactive effluent. This paper examines a screening technique for estimating long-term average radionuclide air concentrations within approximately 100 m of a building from which the release occurs. The technique is based on a modified gaussion plume model (HB model) which considers the influence of the tallest building within 100 m and is independant of atmospheric stability and downwind distance. 4 references, 2 tables.

38409 **(DOE/ER/60095—T2) Source characterization and transport processes affecting levels of radon and its decay products in an indoor environment. Final technical report.** Wilkening, M.; Schery, S.D. (New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Physics). Jul 1984. Contract AC04-82ER60095. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015254.

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Research performed under contract to DOE is summarized. Specific topics discussed include: exhalation of radon and thoron from soil at a field station; indoor radioactivity-measurements and models; instrumentation development; radon in indoor and outdoor

locations using passive track-etch detectors; ions and aerosols; and radon levels and air exchange in caves. 2 tables. (MF)

38410 **(DPST—83-270-Rev.1) Environmental dosimetry for normal operations at SRP. Revision 1.** Marter, W.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA)). 22 Mar 1984. Contract AC09-76SR00001. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014980.

The radiological effect of environmental releases from SRP during normal operations has been assessed annually since 1972 with a dosimetry model developed by SRL in 1971 to 1972, as implemented in the MREM code for atmospheric releases and RIVDOSE code for liquid releases. Starting in 1978, SRL started using environmental models and dose commitment factors developed by Nuclear Regulatory Commission (NRC) for all other environmental dose calculations. The NRC models are more flexible than the older SRL models, use more up-to-date methodologies, cover more exposure pathways, and permit more detailed analysis of effects of normal operations. It is recommended that the NRC models, as implemented in the computer codes X0QD0Q and GASPAR for atmospheric releases and LADTAP for liquid releases, and NRC dose commitment factors be used as the standard method at SRP for assessing offsite dose from normal operations in Health Protection Department annual environmental monitoring reports, and in National Environmental Policy Act documents and Safety Analysis Reports for SRP facilities. 23 references, 3 figures, 9 tables.

38411 **(EGG—10282-1002) Aerial radiological survey of the Idaho National Engineering Laboratory, Idaho Falls, Idaho. Date of survey: June 1982.** (EG and G Energy Measurements, Inc., San Ramon, CA (USA)). Feb 1984. Contract AC08-83NV10282. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014678.

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An aerial radiological survey of the Idaho National Engineering Laboratory (INEL) was conducted during June 1982 by EG and G Energy Measurements, Inc. for the United States Department of Energy (DOE). The survey consisted of airborne measurements of both natural and man-made gamma radiation from the terrain surface in and around the INEL site. These measurements allowed an estimate of the distribution of isotopic concentrations in the survey area. Results are reported as isopleths superimposed on maps and photographs of the area. Gamma ray energy spectra are also presented for the net man-made radionuclides. The survey was designed to cover all of the area within a 2 mile radius of any facility at the INEL. Several areas of man-made activity were detected. These areas are all known working or storage areas which are associated with normal operations at the INEL. 3 references, 48 figures, 5 tables.

38412 **(EML—419) Spectral stripping method for a GE spectrometer used for indoor gamma exposure rate measurements.** Miller, K.M. (Department of Energy, New York (USA). Environmental Measurements Lab.). Jul 1984. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015736.

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A gamma ray spectrum stripping method has been adapted to a Ge spectrometer for in situ measurements of exposure rates in air. This method involves subtracting out from a collected spectrum those counts that represent cosmic-ray events or partial absorption of gamma rays in the detector. The resultant total absorption spectrum is converted to flux incident at the detector, which is then used to compute exposure in air. The appropriate stripping and flux conversion parameters were determined by calibrating the detector for both full absorption peak and partial absorption continuum efficiency for parallel incident flux. This technique has particular application in indoor radiation measurements, where separate estimates of the gamma and cosmic ray exposure rates are desired and can also be used for deriving the energy distribution of a gamma-radiation field. 12 references, 4 figures, 2 tables.

38413 (INIS-mf—8981, pp vp) **Measurement of radon, radon daughters and thoron concentrations by multi-detector devices. No. E/12.** Somogyi, G.; Varga, Zs. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete); Paripas, B. (Koezegeszseguegyi es Jarvanyuegyi Intezet, Miskolc (Hungary)). 1983. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780475. (CONF-830969—).

From 12. international conference on solid state nuclear track detectors; Acapulco, Mexico (4 Sep 1983).

There is a growing interest in collection of data concerning human exposures to naturally occurring alpha-emitting radionuclides (e.g. in mines, dwellings, building materials, industrial wastes, coal fuel cycle, water supply, soil, plants, etc.). Most of such studies are incomplete for the following reasons: in radon measurements the contribution of thoron is generally neglected, the determination of equilibrium factor is complicated or not possible at all, short- and long-term concentration fluctuations cause difficulties in obtaining representative mean values, the plate-out effect is generally not taken into account. A variety of simple methods were studied that could be used to overcome some of these difficulties by using cups equipped with two or more alpha-sensitive nuclear track detectors. A theoretical foundation of the quantitative measurements with such devices is presented. Experimental data are reported on radon, radon daughters and thoron concentrations measured by multi-detector devices in cave soil gas and in air of Hungarian dwellings. (author).

38414 (KAERI/RR—386-1/82, pp 73-289) **Management of national radioactivity monitoring stations.** Lee, C.H.; Lee, H.D.; Ahn, B.W.; Lee, W.Y.; Park, D.W. 1983. (In Korean). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780327.

In Environmental impact studies around nuclear facilities.

The survey and Monitoring of environmental radioactivity for total deposit, air-borne dust, precipitation, and surface soil and pine needles were done national wide through the survey network of the Regional Radioactivity Monitoring Stations in this year as a continuous program since 1964. And measurements of environmental radiation were also included employing a portable count-rate meter and thermoluminescent dosimeters.

38415 **(LA—9445-PNTX-C) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: radiation monitoring and radiological assessment of routine releases.** Buhl, T.; Dewart, J.; Gunderson, T.; Talley, D.; Wenzel, J.; Romero, R.; Salazar, J.; Van Etten, D. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 132p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008062.

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This report documents work perfomed in support of the preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. Results of environmental measurements performed for the EIS are described. Descriptions are presented are presented of existing radiological conditions at the Pantex Plant and the two alternate sites, the Iowa Army Ammunition Plant near Burlington, Iowa, and the Hanford Site in Washington. Radiological impacts on these three sites by the proposed options and alternatives considered in the EIS are evaluated. Only impacts from routine operations are considered; impacts from accidents are treated in other reports.

38416 **(NCRP—76) Radiological assessment: predicting the transport, bioaccumulation, and uptake by man of radionuclides released to the environment.** (National Council on Radiation Protection and Measurements, Bethesda, MD (USA)). 15 Mar 1984. 309p. NCRP Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814. Order Number TI84901624.

This report reviews the current status of the application of radionuclide transport models from the point of discharge to the environment to the point of intake by man. Models are reviewed that describe the transport of radionuclides through the atmosphere, surface and ground waters, deposition on terrestrial surfaces and in sediments, and acccumulation in food products. Usage fac-

tors are considered that determine the intake of radionuclides by humans due to dietary habits, physiological parameters, and living customs. Report includes an in-depth analysis of the data base accompanying these models in order to examine potential uncertainties inherent in the choice of model input parameters. Where available, model validation experimental results are included. References.

38417 **(NLCO—2018) Feed Materials Production Center environmental monitoring annual report for 1983.** Fleming, D.A.; Ross, K.N. (NLO, Inc., Cincinnati, OH (USA)). Aug 1984. Contract AC05-76OR01156. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015465.

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This report contains environmental monitoring data collected at the Feed Materials Production Center (FMPC) during 1983. These data show that the discharges of radioactive contaminants from FMPC operations were only a fraction of the Department of Energy guide levels published in DOE Order 5480.1A. The resulting offsite radiation exposures were, therefore, a small fraction of the standards for uncontrolled areas. Concentrations of environmentally important nonradioactive contaminants in water and air are also reported. Results show good compliance with applicable standards for these contaminants. 8 references, 8 figures, 17 tables.

38418 **(NUREG/CR—3735) Accident-induced flow and material transport in nuclear facilities: a literature review.** Bolstad, J.W.; Gregory, W.S.; Martin, R.A.; Tang, P.K.; Merryman, R.G.; Novat, J.; Whitmore, H.L. (Los Alamos National Lab., NM (USA)). Apr 1984. Contract W-7405-ENG-36. 44p. (LA—10079-MS). NTIS, PC A03/MF A01 - GPO; GPO Dep. Order Number DE84014113.

The reported investigation is part of a program that was established for deriving radiological source terms at a nuclear facility's atmospheric boundaries under postulated accident conditions. The overall program consists of three parts: (1) accident delineation and survey, (2) internal source term characterization and release, and (3) induced flow and material transport. This report is an outline of pertinent induced-flow and material transport literature. Our objectives are to develop analytical techniques and data that will permit prediction of accident-induced transport of airborne material to a plant's atmospheric boundaries. Prediction of material transport requires investigation of the areas of flow dynamics and reentrainment/deposition. A review of material transport, fluid dynamics, and reentrainment/deposition literature is discussed. In particular, those references dealing with model development are discussed with special emphasis on application to a facility's interconnected ventilation system. 176 references.

5004 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 50040038401, 38402

5005 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 50050037646

5006 Regulations

REFER ALSO TO CITATION(S) 50060037759

38419 **(CONF-840612—14) Demonstrating air quality improvements: a review of alternatives.** Hunsaker, D.B. Jr. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014274.

From Air Pollution Control Association annual meeting; San Francisco, CA, USA (25 Jun 1984).

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The 1977 Clean Air Act Amendments specify that emissions data should be used to demonstrate improvements in air quality. This annual determination is known as demonstrating Reasonable Further Progress (RFP) towards attaining the National Ambient Air Quality Standards. Data types and analysis techniques are evaluated as alternative mechanisms for demonstrating RFP. Further, the suitability of emission and ambient data as RFP indices are examined and the use of time series analysis as an alternative to plotting data on an RFP schedule is discussed. 28 references, 1 figure.

38420 **(PB—84-183292) NOAA-ERL-ARL (National Oceanic and Atmospheric Administration-Environmental Research Lab.-Air Resources Lab.) solar uv radiation and climate research project program description and progress report.** Donnelly, R.F.; Puga, L.C.; Repoff, T.P.; Lean, J.L. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Air Resources Lab.). Feb 1984. 145p. (NOAA-TM-ERL-ARL—126). NTIS, PC A07/MF A01.

Contents: Solar uv radiation and climate research project; Atmospheric effects of solar uv variability; Analysis of solar uv variations; Models of solar uv spectral irradiance; Measurements of solar uv spectral irradiance; Studies of Ca-K plages and solar indices; Publications and presentations; Intermediate-term epochs in solar UV emission at 180 nm; Spectroradiometer design rationale; Received ultraviolet radiation at the South Pole; Project for improved performance of radiometric standard detectors (110 - 360 nm).

38421 **(PB—84-194208) European views on controlling acid rain. Final report.** Fay, J.A. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Feb 1984. 17p. (MIT/EL—84-002). NTIS, PC A02/MF A01.

The National Governors Association (NGA) will be considering a plan for alleviating acid rain effects by reduction of emissions of sulfur and nitrogen oxides. This plan, in some respects similar to current legislative proposals in Congress, was formulated by the northeastern governors with administrative support from the Commonwealth of Massachusetts. Lt. Governor John Kerry has undertaken to prepare this plan for consideration by the NGA. In order to provide a better understanding of how other industrialized nations are dealing with the acid rain problem, the office of Lt. Gov. Kerry arranged for a tour of European countries during the week beginning 10 January 1984. Norway, Sweden, the Federal Republic of Germany (FRG), Belgium and the United Kingdom (UK) were visited, as well as the Commission of the European Communities (EEC) in Brussels.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 51010038380, 38480

38422 **(FWS/OBS—84/04) Ecology of Pacific Northwest coastal sand dunes: a community profile.** Wiedemann, A.M. (Evergreen State Coll., Olympia, WA (USA)). Mar 1984. 145p. NTIS, PC A07/MF A01. Order Number DE84901686.

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Sand dunes occur in 33 localities along the 950 km of North American Pacific coast between the Straits of Juan de Fuca (49°N) and Cape Mendocino (40°). The dune landscape is a mosaic of dune forms: transverse ridge, oblique dune, retention ridge, foredune, parabola dune, sand hummock, blowout, sand plain, deflation plain, dune ridge, swale, remnant forest, and ponds and lakes. These forms are the basic morphological units making up the four dune systems: parallel ridge, parabola dune, transverse ridge, and bay dune. Vegetation is well-developed on stabilized dunes. Of the 21 plant communities identified, nine are herbaceous, five are shrub, and seven are forest. A wide variety of vertebrate animals occur in seven distinct habitats: open dunes, grassland and meadow, shrub thicket, forest, marsh, riparian, and lakes and ponds. Urban development, increased rate of stabilization due to the introduction of European beachgrass (Ammophila arenaria (L.) Link), and massive disturbance resulting from heavy off-road vehicle traffic are the greatest threats to the long-term survival and stability of a number of sand dune habitats. Two animals and three plants dependent on

dune habitats are listed as rare, threatened, or endangered. 93 references, 52 figures, 13 tables.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 51020037123, 37316, 38384, 38405, 38417, 38462

38423 **(PB—84-167576) Comparison of innovative technology for thermal destruction of hazardous waste.** Lee, C.C. (Environmental Protection Agency, Cincinnati, OH (USA). Industrial Environmental Research Lab.). 1984. 49p. (EPA—600/D-84-057). NTIS, PC A03/MF A01.

This paper briefly summaries and compares six technologies which are considered to be innovative to the thermal destruction of hazardous wastes. The six technologies are: Fluidized Bed, Molten Salt, High Temperature Fluid Wall, Plasma Arc, Wet Air Oxidation and Supercritical Water. This paper concludes that: Tests of a few technologies have shown that the selected waste can be destroyed to meet the 99.99% DRE requirement, Wet Air Oxidation apparently has the lowest temperature and the longest residence time requirement, plasma has the highest temperature characteristic, and Supercritical water has the highest pressure requirement.

38424 **(PB—84-184902) Laboratory-scale flame-mode hazardous waste thermal destruction research.** Kramlich, J.C.; Heap, M.P.; Pohl, J.H.; Poncelet, E.; Samuelsen, G.S. (Energy and Environmental Research Corp., Irvine, CA (USA)). Apr 1984. 155p. NTIS, PC A08/MF A01.

This research is to investigate the flame mode incinerability of hazardous waste compounds. It was also designed to provide a comparison between flame and non-flame destruction of compounds and act as a guideline for future work on the development of an acceptable incinerability ranking methodology. Two flame reactors were used in order to simulate a wide variety of failure conditions for liquid injection incinerators. The first reactor was called a microspray and consisted of droplets injected into a hydrocarbon flat-flame. The second reactor was a turbulent flame reactor which allowed the investigation of failure conditions in spray flames such as mixing, atomization and quench phenomenon. The compounds investigated included: chloroform, 1,2-dichloroethane, benzene, chlorobenzene, and acrylonitrile.

38425 **(PB—84-187970) Assessment of solid waste disposal practices in rural communities in Alaska. Final report.** Tilsworth, T. (Alaska Univ., Fairbanks (USA)). May 1984. 55p. NTIS, PC A04/MF A01.

A study was conducted of solid waste management practices in remote communities of Alaska during 1980-1982. This study was conducted in cooperation with the Alaska Department of Environmental Conservation. Solid waste management problems were identified for small communities in cold regions and analyses were conducted to determine viable alternatives, including open dumps, modified landfills and incineration. A very limited sampling program was conducted to determine solid waste characteristics. National and international literature was reviewed, including that of Canada. The project included site visits to several small villages, consultation with regulatory officials and discussion with several Canadian agencies and communities. A national survey was conducted relative to state regulations pertaining to small community practices. The results of the study identified many problems existing in small communities in cold climates and found that in many cases state regulations are not enforced and may not be appropriate. The study includes an analysis of solutions and alternatives available.

38426 **(PB—84-195270) Annotated literature references on land treatment of hazardous waste. Final report Aug 81-Apr 84.** Galegar, J. (East Central Oklahoma State Univ., Ada (USA)). May 1984. 475p. NTIS, PC A20/MF A01.

The major environmental problem in the decade of the 1980's will be the safe disposal of hazardous and municipal wastes and residues. Land treatment can be used to achieve specific effects through utilization of various management schemes. Through proper management of the land processes, soil characteristics may be altered to produce more productive soil, vegetation, and a cost-effective treatment process. This publication represents one of a five part response to the grant on Land Treatment of Industrial Waste. This portion provides technical literature annotations of land treatment processes for chemical, hazardous, and industrial solid wastes. Since the concept of land treatment process is relatively new for industrial waste, information is widely scattered. Approximately eight hundred thirty publications, including material through the year 1982, have been reviewed and annotated in this report.

38427 **Comment on acid precipitation in historical perspective and effects of acid precipitation.** Richter, D.D. (Oak Ridge National Lab., TN). *Environmental Science and Technology;* **17**: No. 9, 568-570(1983). Contract W-7405-ENG-26.

An overview is presented of the history of the problem of acid rain. Lake and stream water are classified as sensitive to acid rain largely on the basis of buffering capacity of soils and geological substrate. Evidence for acid precipitation causing the acidification of lakes and streams on a regional basis is not conclusive. However, soil genesis and forest development can be acidifying processes in humid climates. Acid rain is increasing soil aluminum solubility and leaching to surface water in concentrations toxic to fish. Under natural conditions of podzolization, aluminum is mobilized in surface soils and subsequently retained by spodic subsoils. Whether acid rain appreciably accelerates aluminum leaching from soils is hypothetical. It is concluded from one report that acid precipitation is related to increases in the accumulation and spatial variations of forest floors, soil acidification, exchangeable aluminum, aluminum released from clay, and internal ecosystem H^+ ion production. But, these conclusions are based on limited sampling. 28 references.

38428 **Extraction of nutrients from intact soil cores to assess the impact of chemical toxicants on soil.** Jackson, D.R.; Hall, J.M. *Pedobiologia;* **18**: 272-278(1978).

A technique was developed for extracting nutrient pools from intact soil cores by successive leaching with solutions of M KCl, distilled water, and 0.5 M Na HCO_3. In this manner, analyses were completed for Ca, NH_3-N, NO_3-N, PO_4-P, and dissolved organic carbon from a single core. Experiments were conducted on silt loam soil which was easily excised intact. No significant differences were found between nutrients extracted from intact and homogenized coil cores. This technique was compared to the slurry method for detection of soil nutrient loss resulting from chemical contamination. The slurry was found to be less effective than the leaching method. The leaching method may allow the assessment of nutrient loss from contaminated soil before productivity of soil biota is severely depressed. Ultimately, the leaching method may be used for assessing the potential toxicity of new chemicals to terrestrial ecosystems.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 51030037272, 37293, 37347, 38409, 38411, 38415, 38416, 38417, 38462, 38590, 38604

38429 **(DOE/OR/20722—7) Radiological survey report for the Weldon Spring Raffinate Pits site, Weldon Spring, Missouri.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Aug 1984. Contract AC05-81OR20722. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015853.

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The Weldon Spring Site (WSS) is a US Department of Energy (DOE) surplus facility comprising the Raffinate Pits facility, the Quarry, and potentially contaminated vicinity properties. Radiological characterization of the WSS will be conducted in three phases: the Raffinate Pits facility, Quarry, and the vicinity properties. Bechtel National, Inc. (BNI) and its radiological support subcontractor, Eberline Instrument Corporation (EIC), conducted a radiological characterization survey of the Raffinate Pits during 1982 and 1983 in support of on-site construction work and a technical evaluation of site geology. The survey consisted of direct beta-gamma surface readings, near-surface gamma readings, exposure

level measurements, and gamma-logs of boreholes. Soil samples were also collected from the surface, shallow boreholes, and trenches on the site. This report describes the radiological characterization of the Raffinate Pits facility, the procedures used to conduct the survey, the survey results, and their significance. 5 references, 9 figures, 8 tables.

38430 **(EML—429) Strontium-90 in the US diet, 1982.** Klusek, C.S. (Department of Energy, New York (USA). Environmental Measurements Lab.). Jul 1984. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015737.

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Estimates of ^{90}Sr intake via the total diet in New York City and San Francisco have been made since 1960 from quarterly food samplings and average consumption statistics. The dietary intake of ^{90}Sr has decreased from the maximum levels attained during 1963-1964, but the decline has become more gradual in recent years due to the continuing small amounts of ^{90}Sr deposition and the little-changing cumulative deposit of ^{90}Sr in soil. The annual intake in 1982 averaged 5.4 pCi/day (0.20 Bq/day) in New York, and 2.6 pCi/day (0.096 Bq/day) in San Francisco, little changed from the previous year. Further gradual reductions in ^{90}Sr intake are anticipated during 1983. 1 reference, 7 figures, 4 tables.

38431 (KAERI/RR—386-1/82, pp 3-72) **Studies on the translocation and accumulation of radionuclide in the terrestrial ecosystem.** Lee, C.H.; Ryu, J.; Ahn, J.S.; Kim, J.S.; Kim, J.S. 1983. (In Korean). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780327.

In Environmental impact studies around nuclear facilities.

Recently, environmental effects in the vicinity of reactors are attached great importance on the radioactive chemicals and heat which are released from nuclear power plant, and on their movement through the environment. In order to monitor the levels of radioactive accumulation at the surroundings of nuclear power plant, the levels of radionuclides in the soil, crops and water resources around the nuclear facilities was determined. Translocation and accumulation of radioactivity in rice plant was also determined with the treatment of different potassium levels to soil.

38432 **(KAERI/RR—386-1/82) Environmental impact studies around nuclear facilities.** (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 306p. (In Korean). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84780327.

Separate abstracts have been prepared for individual items for inclusion in the Energy Data base.

38433 (KAERI/RR—386/82, pp 331-417) **Impact assessment on the human exposure to environmental radiation.** Kim, Y.J.; Lee, K.S.; Kim, J.B.; Chun, K.J.; Kim, S.R.; Chung, K.H. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780328.

In Environmental impact studies around nuclear facilities.

The first assessment is on the Terrestrial Ecosystem in the Vicinity of Kori Nuclear Power Plant. In order to evaluate the effects of radiation or radionuclides released from the nuclear power plants on human population, field surveys on the terrestrial ecosystem such as the fauna and flora in the vicinity within 15 km from the Kori nuclear power plant were carried out. The present study was undertaken with the purpose for evaluating 1) the level of Sr-90 in the Korean vertebra, 2) the metabolism of Sr-90 in the rats, 3) the levels of Sr-90 and Cs-137 in the pine needles (Pinus densiflora), 4) the level of Sr-90 in the frogs (Rana nigromaculata) and 5) the radiation effects by internal Sr-90 on the bone marrow.

38434 (KAERI/RR—386/82, pp 117-255) **Environmental radiation monitoring around the nuclear facilities.** Lee, H.D.; Ahn, B.W.; Lee, W.Y.; Park, D.W. 1983. (In Korean). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780328.

In Environmental impact studies around nuclear facilities.

A portable count-rate meter (Eberline, Model PRS-1, mica end-window type G-M detector, ~2.0 mg/cm^2) and thermoluminescent detectors ($CaSO_4$; Dy) for the environmental Radiation Monitoring have been used to obtain total gamma dose rates at 23 locations within a 30km radius of the Kori Nuclear Power plant and it's surroundings area. Also environmental Radiation monitors (Reuter Stokes, RSS-111, Spherical high pressurized ionization chamber) have been employed for continuous monitoring of environmental radiation at four locations, which are Eonyang, Onsan, Ulsan, and Busan. The measurement of gross alpha and beta radioactivities of the surface soil and of the pine needles also have been made.

38435 **(KAERI/RR—386/82) Environmental impact studies around nuclear facilities.** (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 429p. (In Korean). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780328.

Separate abstracts have been prepared for each paper for inclusion in the Energy Data base.

38436 **(LA—9445-PNTX-M) Supplementary documentation for Environmental Impact Statement regarding the Pantex Plant: agricultural-food-chain radiological assessment.** Wenzel, W.J.; Wallwork-Barber, K.M.; Horton, J.M.; Rea, K.H.; Hollis, L.C.; Gladney, E.S.; Mayfield, D.L.; Gallegos, A.F.; Rodgers, J.C.; Thomas, R.G. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 59p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008072.

This report documents work performed in support of preparation of an Environmental Impact Statement regarding the Department of Energy's (DOE) Pantex Plant near Amarillo, Texas. Soil, water, vegetation, and beef cattle were sampled on the Pantex Plant and the general experimental treatments analyzed for a feedlot experiment. The chemical and radiochemical methods used for analyzing these samples at the Los Alamos National Laboratory are discussed for each sample type. The radiation levels found in water, soil, range vegetation, sorghum, and beef cattle from sampling on and near the Pantex Plant are compared to natural background levels. Their significance is interpreted as radiation doses from ingestion of meat.

38437 **Movement of radiostrontium in the soil profile in an arid climate.** Cline, J.F.; Caldwell, L.L. (Pacific Northwest Lab., Richland, WA). *Health Physics;* **46**: No. 5, 1136-1138(May 1984). Contract AC06-76RL01830.

In 1954 a study was initiated to examine the uptake of ^{90}Sr by agricultural crops from contaminated soil under environmental conditions. The study design consisted of 12 small field plots (3.7 m^2 each) placed on an abandoned agricultural field at the Hanford Site in southeastern Washington. Several agricultural treatment plots and one control plot (no cropping) were surface contaminated with carrier-free ^{90}Sr. The control plot has since been maintained and provides an opportunity to examine the vertical movement of surface-applied ^{90}Sr in an undisturbed abandoned agricultural soil through time. The ^{90}Sr distribution in the soil profile through 1970, 16 yr after contamination of the soil, was reported. The soil profile distribution of ^{90}Sr for the same plot in 1980, 26 yr after it was contaminated and 16 yr after it was last irrigated is compared with results from 1970 sampling.

38438 **Tritium deposition in pine trees and soil from atmospheric releases of molecular tritium.** Sweet, C.W.; Murphy, C.E. Jr. (E. I. du Pont de Nemours & Co., Aiken, SC). *Environmental Science and Technology;* **18**: No. 5, 358-361(May 1984). Contract AC09-76SR00001.

Much of the tritium found in soil and leaf litter near a chemical separations facility is incorporated into soil organic matter in a stable, nonexchangeable form. Formation of this "bound" tritium seems to result from the uptake of molecular tritium (HT) by living pine needles. A deposition velocity (V/sub d/) for HT of 1.2 x 10^{-5} cm/s was measured in pine needles. About 1% of the tritium deposited in this way is converted into organic matter. Soil and litter microbes convert HT to HTO more rapidly (V/sub d/ = 0.01 cm/s), but no measurable organic tritium is formed.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 51050037187, 37297, 37298, 37299, 37327

38439 **(AD-A—140226/2) Installation Restoration Program. Phase I. Records search, hazardous materials disposal sites, Eglin AFB, Florida. Report for Apr-Oct 81.** (Engineering-Science, Inc., Atlanta, GA (USA)). 1 Oct 1981. 298p. NTIS, PC A13/MF A01.

This report summarizes the Installation Restoration Program (IRP) Phase I study results at Eglin AFB, FL. The effort determines if there may exist hazardous waste site on-site via a records search and personnel interviews. Thirty potential sites were identified. This effort will be followed by IRP Phase II in which field data will be collected to verify and define the sites.

38440 **(EGG—10282-2039) Surveys for plant species of concern on northern and eastern Yucca Flat, Nevada Test Site, Nye County, Nevada.** Collins, E.; O'Farrell, T.P. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). Apr 1984. Contract AC08-83NV10282. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015070.

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Ground surveys of the northern and eastern portions of the Yucca Flat drainage basin on the US Department of Energy's Nevada Test Site, Nye County, Nevada, were conducted to determine the distribution of rare plants, or species of concern. This information was needed to help DOE evaluate whether all proposed surface disturbances in the basin must be preceded by a preconstruction survey to assess possible impacts on species of concern. Fourteen areas in both bajada and mountainous habitats were surveyed between August 11 and 25, 1983. Six species of concern were found at 11 localities in mountainous terrain, but none were found on bajadas. 11 references, 7 figures.

38441 **(NUREG/CR—3583) Evaluation of low-altitude remote sensing techniques for obtaining site characteristic information.** Estes, J.E.; Scepan, J.; Ritter, L.; Borella, H.M. (California Univ., Santa Barbara (USA); EG and G, Inc., Goleta, CA (USA)). Apr 1984. 77p. (S—762-R). NTIS, PC A05/MF A01 - GPO. Order Number TI84901584.

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The potential of photographic remote sensing for demographic and environmental monitoring was assessed. Aerial infrared imagery and ground truth along with collateral data provided information on site area demographics and land use, land cover characteristics. The ability to determine transient populations from remotely sensed data was also evaluated. Both manual and machine-assisted techniques for extracting these data from reflectance infrared images were qualitatively assessed. The NASA Aircraft Programs 'U-2' acquired color infrared imagery at scales of 1:65,000 and 1:130,000, and Keystone Aerial Surveys (Philadelphia, Pennsylvania) using a Lear-Jet acquired color infrared imagery at scales of 1:36,000, 1:48,000, 1:60,000, and 1:80,000. Data on residence types and counts, industrial facilities types and location, transient facilities, transportation networks, and the location of water bodies were generated specifically for the study site surrounding the Limerick Power Station in Pottstown, Pennsylvania. Of the three techniques of population estimations examined, the Dwelling Unit method was evaluated for respective utility and accuracy within NRC guidelines. The level of spatial and classification accuracy of the derived products depended on both scale and image quality. Area weighted thematic accuracy from manual analysis was 96%, while by-category accuracies ranged from 71% to 100%. 18 references, 30 figures, 5 tables.

38442 **(PB—84-135797) Investigation of soil and water contamination at Western Processing, Inc., King County, Washington. Part 2. Report for Sep-Nov 82.** (Environmental Protection Agency, Seattle, WA (USA). Region X). May 1983. 248p. (EPA—910/9-83/104B). NTIS, PC A11/MF A01.

See also Part 1, PB84-135789.

Western Processing, Inc., Kent, Washington, which operated as an industrial waste recycling facility, was suspected of having contaminated soil, groundwater and surface water on and around its 13-acre site. After intensive sampling and analysis, significant levels of many toxic substances were identified in a high proportion of the soil and groundwater samples; these included 21 known carcinogens and 28 suspected carcinogens. At least 19 of the soil samples and six of the groundwater samples were defined as hazardous waste by standards of the Resource Conservation and Recovery Act (RCRA) by reason of their content of soluble toxic metal.

38443 **(PB—84-187913) Production and management of leachate from municipal landfills: summary and assessment. Final report Sep 79-Mar 82.** Lu, J.C.S.; Eichenberger, B.; Stearns, R.J.; Melnyk, I. (Calscience Research Inst., Huntington Beach, CA (USA)). May 1984. 474p. NTIS, PC A20/MF A01.

An assessment was made to evaluate production and management of leachate from municipal landfills for purposes of identifying practical information and techniques which may be useful to design engineers and site operators. Also assessed were: advantages, limitations, and comparative costs of various approaches for the estimation and mitigation of environmental and public health impacts, management options, and additional research needs on the generation, control, and monitoring of landfill leachates. Numerous mathematical models have been proposed for estimating leachate generation and are usually based on the water balance method. Several models have been proposed which are fairly successful in simulating the change in leachate strength with increasing landfill age or cummulative leachate volume. A zone of saturation monitoring program is established to give a prompt indication of ground water contamination.

38444 **(PNL—5185) Investigation of Stinson Beach Park storm damage and evaluation of alternative shore protection measures.** Ecker, R.M.; Whelan, G. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015145.

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An investigation was made of storm damage during the winter of 1982-83 to the National Park Service's Stinson Beach Park. The investigation included an assessment of the storm damage, evaluation of physical processes contributing to the damage, subsequent beach recovery, and the feasibility of implementing shoreline protection measure to reduce future risk. During the winter of 1982-83, the beach was almost completely denuded of sand, wave overwash damaged the foredune, vegetation on the foredune was destroyed, and backshore flooding occurred. Two structures and a parking lot were endangered as the shoreline receded. Subsequent recovery of the park beach was rapid. By January 1982 sand had moved back onshore and a beach berm was beginning to reform. The foredune and dune vegetation received the only permanent damage. Four shoreline protection alternatives were evaluated. These include no action, dune development/enhancement, construction of a rock riprap revetment, and offshore installation of artificial seaweed. The first costs (estimated costs, excluding maintenance) range from about $90,000 to $475,000. The least-cost protection measure is riprap revetment, which protects the two structures and parking lot endangered during the 1982-83 winter storms. Construction of a foredune along the entire park beach is the highest cost protection measure. If no shore protection action measures are implemented, wave overwash of the foredune can be expected to occur on the average of every 2 to 3 years, and beach degradation, similar to that during the 1982-83 winter, can be expected to occur on the average of every 10 to 12 years. 12 references, 19 figures, 18 tables.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 52010038464

38445 (OSS/RR—1) Macroinvertebrates of Magela Creek, Northern Territory. Marchant, R. (Office of the Supervising Scientist for the Alligator Rivers Region, Sydney (Australia)). Apr 1982. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702566.

The littoral zones of five permanent billabongs in Magela Creek were sampled monthly for macroinvertebrates. Greatest numbers of taxa and individuals were caught in the late wet season and early dry season in the shallow billabongs; in the deep billabongs, seasonal variations were not so marked. These changes appeared to be associated with the development of macrophytes, which offered food and shelter to the invertebrate fauna. The dominant groups were the Chironomidae, Oligochaetae and Ephemeroptera. The seasonal patterns of the catches were sufficiently consistent for future samples to be able to be compared with these initial ones with some confidence that any changes are real. This work is part of a larger study into the biota and water quality of Magela Creek designed to provide data on aquatic communities before mining of the Ranger uranium deposit starts.

38446 (OSS/TM—4) Foraging behaviour of herons and egrets on the Magela Creek flood plain, Northern Territory. Recher, H.F.; Holmes, R.T. (Office of the Supervising Scientist for the Alligator Rivers Region, Sydney (Australia)). Mar 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702567.

Five species of diurnal herons are common on the Magela Creek flood plain and forage along the edges of natural and artifical waterbodies both inside and outside the Ranger Uranium Project Area. The species of heron differ in the kinds and sizes of prey they take, their foraging location, degree of sociality and foraging behaviour. Because it takes relatively large fish, the Great Egret, E. alba, is most likely to be affected by any contamination of the aquatic environment by heavy metals or radionuclides. The Nankeen Night Heron, Nycticorax caledonicus is also abundant on the flood plain and probably feeds on large fish and frogs. The other herons take smaller or immature prey or hunt mostly in terrestrial habitats and are therefore less likely to be affected by contamination of the aquatic environment.

38447 Infiltration and runoff predictions for a grassland watershed. Luxmoore, R.J. (Oak Ridge National Lab., TN). *Journal of Hydrology;* **65**: 271-278(1983). Contract W-7405-ENG-26.

Field-determined infiltration characteristics used as input to an infiltration equation combined with adjusted parameters in a variable contributing area (VCA) algorithm of a hydrologic model were used to provide agreement between the annual simulated runoff and measurements from the grassland watershed site. Any discrepancy in Hortonian runoff from the infiltration calculations was compensated for by VCA runoff in the hydrologic simulation. Evaluation of the VCA parameterization suggested that contributions of VCA runoff to total streamflow were unreasonably high and that the infiltration parameters overpredicted annual infiltration. It is recommended that field measurements of infiltration characteristics for hydrologic studies be obtained during the season with predominant Hortonian runoff.

38448 Relationships between morphology of small streams and sediment yield. *Journal of the Hydraulics Division, American Society of Civil Engineers;* **108**: No. HY11, 1328-1365(Nov 1982).

The state of the art in the relations between morphology of small streams and sediment yield is assessed. Research findings and recommendations for additional research are presented. Topics include systems and interactions, simulation models, channel forms and processes, transport of sediment in small streams, and aspects of channel morphology. Selected topics for additional research are also included.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 52020037123, 37124, 38405, 38417, 38427, 38462, 38463, 38617, 38659

38449 (BNL—34956-Vol.1) Analysis of trends in the chemistry of surface waters of the United States. Annual report for NAPAP projects E1-8 and E2-11. Final report for IAG No. DW89930347-01-0. Volume 1. Hendrey, G.R.; Hoogendyk, C.G.; Gmur, N.F. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 205p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84014577.

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The Acidification Chemistry Information Database (ACID) was established to analyze regional and national effects of acid deposition on surface waters. Linear trend analysis of the data showed SO_4 and H concentrations declining and alkalinity increasing in the New England-New York region. These data are from the 1970's when regional emissions were declining and support the hypothesis that water chemistry trends are associated with acid deposition. National trends show SO_4 declining in the northeast and midwest and increasing in the southeast. This agrees with emissions trend data for the regions. Average SO_4 concentrations from New England-New York in 1970 and emission data from 1967 to 1970 correlate. Other calculations based on mass balance support the correlation between emissions and regional surface water SO_4. In one approach, emissions for the region dissolved into precipitation yielded concentrations slightly less than those observed in surface waters. While this ignores soil processes and transport out of the region, it suggests a causal relationship when taken together with the close temporal tracking of emissions by surface water sulfate. In a second approach, wet deposition for 1980 was doubled to estimate total deposition and dissolved into water runoff for each state. The average result equalled 91% of observed sulfate in surface waters with an R^2 of 0.69 and $p = 0.02$. These three independent analyses indicate that atmospheric deposition of sulfur may be the dominant factor regulating both the total concentration and temporal pattern of SO_4 in surface waters of the New England-New York region. 58 references, 22 figures, 11 tables.

38450 (BNL—34956-Vol.2) Analysis of trends in the chemistry of surface waters of the United States. Annual report for NAPAP Projects E1-8 and E2-11. Final report for IAG No. DW 89930347-01-0. Appendix III. Trend list. Volume 2. Hendrey, G.R.; Hoogendyk, C.G.; Gmur, N.F. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 359p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84014578.

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This volume contains a complete list of trend analyses on all 6117 stations in ACID for which adequate data are available. Adequate data were defined as at least 10 measurements on the variable of interest representing at least five years. The list includes both upstream and downstream stations, including 583 of the 4164 stations that were randomly sampled from STORET and that have alkalinity values above 500 μeq/l or pH above 7.5. Simple linear regression on time was done for H^+, alkalinity, SO_4, Ca, Ca + Mg, Ca + Mg + Na, and Ca + Mg + Na + K (all expressed in μeq/l). Time was expressed as a Julian date converted to units of years, and the trend coefficients are thus in units of μeq/l/year. The results are in a sense raw data. The main report (volume I) discusses the shortcomings of this type of analysis and attempts to interpret the results for New England plus New York using a regional approach rather than a station by station approach. 1 figure, 1 table.

38451 (CONF-840657—1) Basic issues in water chlorination: a chemical perspective. Jolley, R.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014081.

From 5. water chlorination conference; Williamsburg, VA, USA (3 Jun 1984).

Results from selected research papers published since the last conference (Asilomar, 1981) are reviewed and summarized. Although much progress has been made in developing predictive models for chlorination discharges, additional data are needed for reaction rates and mechanisms over a wider temperature range, especially for transformation and decomposition reactions of chlorine and chlorine-produced oxidants. Significant advances have also been made toward understanding the formation of trihalomethanes and the chlorination of humic materials, and toward identification of chlorination products in cooling waters, paper industry effluents, and wastewaters; however, because of the vast number of chlorination products, much remains unknown in this area. Further research is especially needed to expand our knowledge concerning products from the water chlorination treatment of food materials because only very limited information is available. 102 references.

38452 **(CONF-840688—2) Solution of contaminant transport equations using an orthogonal-upstream finite element scheme.** Yeh, G.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014266.

From 5. international conference on finite elements in water resources; Burlington, VT, USA (18 Jun 1984).

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An orthogonal-upstream weighting finite element scheme, which will result in a matrix amenable to successive over-relaxation (SOR) solution strategies, is presented for approximating the contaminant transport equation in subsurface media. This scheme differs from the standard Galerkin and non-orthogonal-upstream weighting schemes in that the set of weighting functions is required to be orthogonal to the set of basis functions. These weighting functions are referred to as orthogonal-upstream weighting functions and are developed for line, quadrilateral, and triangular elements. Numerical results have been obtained for two examples and are compared with results obtained with analytical solutions and the Galerkin and/or non-orthogonal-upstream weighting schemes. It is found that the direct elimination solutions of the orthogonal-upstream finite element equations yield results comparable to those obtained by the direct solution of the Galerkin and/or non-orthogonal-upstream weighting finite element equations. The SOR computations of the orthogonal-upstream finite element scheme generate convergent solutions for all cases. In contrast, the SOR calculations of the Galerkin and/or non-orthogonal-upstream finite element schemes result in convergent solutions for dispersion-dominant cases, but produce divergent results for advection-dominant cases. For small problems, when the central processing unit (CPU) memory is not a consideration, the direct elimination solutions of the Galerkin and non-orthogonal-upstream finite element methods are the most efficient schemes. For large problems, when SOR iteration must be employed to solve the matrix equation owing to the unavailability of CPU memory, the orthogonal-upstream weighting scheme provides the only alternative because it is the only scheme giving convergent SOR computations for all Peclet numbers. 14 references, 4 figures, 2 tables.

38453 **(CONF-8406143—2) Environmental fate of mercury and cesium-137 discharged from Oak Ridge facilities.** Turner, R.R.; Olsen, C.R.; Wilcox, W.J. Jr. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014265.

From 18. annual conference on trace substances in environmental health; Columbia, MO, USA (4 Jun 1984).

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As a results of past DOE activities on the Oak Ridge Reservation, Oak Ridge, Tennessee, about 110 metric tons (Mg) of Hg and over 500 curies of ^{137}Cs were discharged into the Tennessee River reservoir system between 1949 and 1982. Although different facilities and unrelated operations contributed the two contaminants, the highest annual discharge (33 Mg Hg, 170 Ci ^{137}Cs) for both occurred within a 2 year period (1956 to 1957). The distribution of hg and ^{137}Cs was measured in river-reservoir sediment cores recently collected from 50 to 200 km downstream from the Oak Ridge site. The vertical profiles of Hg and ^{137}Cs in these cores are strongly correlated with documented discharge histories and thus can provide a means of dating specific horizons in the sedimentary deposits. In downstream areas, sediment chronologies based on reservoir age and the distribution chronologies based on reservoir age and the distribution of naturally occurring ^{210}Pb ae concordant with chronologies based on the vertical Hg and ^{137}Cs profiles. The chronologies helped to resolve mercury contributions from a chlor-alkali plant located about 150 km downstream of the Oak Ridge site. 9 references, 6 figures, 1 table.

38454 **(DOE/EV/10611—4) Carbonate chemistry of the Weddell Sea.** Chen, C.T.A. (Oregon State Univ., Corvallis (USA). School of Oceanography). Mar 1984. Contract AT06-81EV10611. 131p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84009713.

Concurrent pH, calcium and total alkalinity data were obtained in the eastern Weddell Sea in the late austral Winter of 1981 as part of the US-USSR Weddell Polynya Expedition aboard the Soviet icebreaker SOMOV. These data represent the initial concentrations of calcium, alkalinity and total CO_2 in the most important source region of world ocean bottom waters at the time they were formed. For the first time we can evaluate the variation of calcium and carbon cycles in the deep oceans referenced to the source water. The Weddell Sea data were analyzed with data reported in the literature, and the results indicate that: the October pH values south of the polar front are indistinguishable from the November values, but the seasonal effect is large north of the front; a large change in pH occurs at the ice edge; partial CO_2 pressure in the Weddell Sea surface water is only slightly lower than the atmospheric value; the alkalinity does not show cross-ice-edge or seasonal variations, but the values seem to increase at a slower rate with decreasing temperature south of the Polar Front; sea ice is relatively high in calcium and alkalinity concentrations; mixing dominates the distribution of chemical properties; pH is useful in identifying the sources of waters in the Weddell Sea, whereas calcium and alkalinity are not; the surface water is deficient in anthropogenic CO_2 because the pack ice blocks the air-sea exchange of gases; and little excess CO_2 can be found in the Antarctic Bottom Water. The situation may change, however, if the Weddell Sea ice coverage is reduced because of CO_2-induced global warming. Two appendices include data for the expedition. 159 references, 60 figures, 5 tables.

38455 **(PB—84-167527) Hazardous chemicals in fish: Wisconsin Power Plant impact study.** Lech, J.J.; Melancon, M.J. (Medical Coll. of Wisconsin, Milwaukee (USA)). Jan 1984. 7p. NTIS, PC A02/MF A01.

The role of fish as vectors for organic chemical contaminants arising from the operation of a coal-fired power plant was assessed by in vivo studies of the fate of selected chemicals and in vitro studies of liver xenobiotic biotransformation enzymes. The results indicate that selected organic chemicals which could be released by a power plant into the aquatic environment, will be taken up by fish and depending upon the particular chemical, will be accumulated to varying extents as parent chemical and biotransformation products. Humans who might consume such fish may be exposed to those chemicals at varying concentrations depending on the water levels of the chemicals. The high concentrations of metabolites of certain chemicals in fish bile make sampling of fish bile a possible monitoring tool.

38456 **(PNL—5045) Chemical analysis of sediment cores from the East Waterway (Everett, Washington). Final report.** Crecelius, E.A.; Bloom, N.S.; Gurtisen, J.M. (Marine Research Lab., Sequim, WA (USA)). Jun 1984. Contract AC06-76RL01830. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014785.

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Chemical data for two sediment cores from the East Waterway of Everett, Washington, indicate that 20 to 30 cm of contaminated sediments are accumulating per year. The concentrations of several heavy metals (Pb, Hg and Cu), polychlorinated biphenyls (PCBs) and petroleum hydrocarbons increase with depth in the sediments suggesting contamination of this waterway has varied by as much as a factor of 10 during the last 5 years. 7 references, 9 figures, 12 tables.

38457 **(UCID—19753) Chemical and hydrogeological evaluation of high-explosive process wastewater discharges at Site 300.** Raber, E. (ed.). (Lawrence Livermore National Lab., CA (USA)). 4 Mar 1983. Contract W-7405-ENG-48. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015035.

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A geotechnical study was conducted to evaluate high-explosive waste water discharge operations at the LLNL Site 300 Process Area. Wastewater is presently disposed of into seven unlined lagoons. The wastewater is not considered hazardous, but may contain varying small amounts of high explosives and solvents. Several tasks were completed in support of this study: (1) a comprehensive survey of lagoon wastewaters and associated groundwaters for potential chemical contaminants; (2) geophysical terrain conductivity surveys at all lagoon sites; (3) a reconnaissance survey of the hydrogeology of the Process Area; and (4) a geotechnical engineering evaluation was completed for each lagoon site. 16 references, 24 figures, 11 tables.

38458 **Assessing the effects of contaminants on the structure and function of aquatic ecosystems.** Giddings, J.M. (Oak Ridge National Lab., TN). pp 245-258 of Environment and solid wastes: characterization, treatment, and disposal. Francis, C.W.; Auerbach, S.I.; Jacobs, V.A. (eds.). Boston, MA; Butterworth Publishers (1983). Contract W-7405-ENG-26.

Ecosystems are the context in which all organisms live, reproduce, interact, and evolve. A balanced approach to environmental impact assessment includes consideration of effects on whole ecosystems as well as analyses of effects on organisms and populations. Potential effects of contaminants on whole ecosystems include changes in energy flow, nutrient flow, or trophic structure. Such changes are generally not predictable from measurements of responses of individual species, but must be determined by investigating whole ecosystems. Responses of aquatic ecosystems to organic and inorganic contaminants have been demonstrated in microcosms (laboratory models of ecosystems) simulating various aquatic environments. 26 references, 1 figure.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 52030037272, 37310, 37312, 37346, 37347, 37348, 38410, 38416, 38417, 38453

38459 **(AERE-R—10847) Uranium series disequilibrium: application to studies of the groundwater system at Altnabreac, Caithness, U.K.** Ivanovich, M.; Kay, R.L.F. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Dec 1983. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84702564.

A study of uranium series disequilibrium signatures in terms of uranium and thorium content and $^{234}U/^{238}U$, $^{230}Th/^{234}U$, and $^{230}Th/^{232}Th$ activity ratios has been carried out on surface and ground waters at Altnabreac, Caithness. The aim of the study was to interpret various isotopic signatures found in this granitic system, in relation to their evolutionary patterns and groundwater residence time. For this purpose analytical techniques of isotope dilution and alpha spectrometry have been developed specifically for the analysis of water and rock samples. In agreement with hydrochemical and isotopic data, uranium series disequilibrium data have delineated two groups of groundwaters: surface and shallow groundwaters, and older deep groundwaters. Very old waters have been recognised at about 300m depth in one of the deep boreholes at the site and a simple model of the decay of ^{234}U excess has yielded an estimated groundwater residence time of the order of tens of thousands of years. This is in reasonable agreement with ^{14}C and ^{4}He data. The thorium content of these groundwaters, ranging from 0.4 to 0.5 $\mu g\ kg^{-1}$, has shown a trend of diminishing concentrations with greater geochemical maturity of groundwaters at depth.

38460 **(CONF-8311110—5) Chemical speciation of Pu in natural waters.** Nelson, D.M.; Larsen, R.P.; Penrose, W.R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014761.

From 6. workshop on environmental research for actinide elements; Hilton Head Island, SC, USA (7 Nov 1983).

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The behavior of plutonium in natural waters is determined to a major degree by the chemical forms which are present. We have characterized the ambient Pu in a number of surface waters with regard to its oxidation state and association with natural colloidal organic carbon compounds using a combination of field measurements and laboratory experiments. Both of these factors are shown to have a profound effect on the adsorption of Pu to natural sediments, since both complexation with organic matter and oxidation compete with adsorption. The concentration of organic carbon in the water is the key variable influencing both oxidation state and organic binding. The adsorption process conforms to the laws applicable to a reversible equilibrium with values of the distribution coefficient, K/sub D/, measured in laboratory experiments being similar to those observed for ambient Pu. Experiments using natural waters and sediments in which the Pu concentration was varied show the forms present at typical ambient concentrations (10^{-17} - 10^{-14} M) are the same as those found at concentrations up to 10^{-7} M. Moreover, the affinity for sediments did not change with concentration indicating the binding sites for Pu had not become saturated. Thus, the behavior observed for Pu at ultratrace concentrations should remain unchanged throughout this concentration range. The studies in this report all deal with Pu in exchangeable (and hence source independent) forms and should therefore reflect the behavior toward which the plutonium from any source will tend with time. 13 references, 7 figures, 10 tables.

38461 **(JINR—R-12-83-66) Attempt to enrich of a new spontaneous fissioning nuclide by evaporation of natural brine.** Adamek, A.; Zhuravleva, E.L.; Constantinescu, M.; Constantinescu, O.; Chuburkov, Yu.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701516.

The enrichment of the new spontaneous fissioning nuclide discovered in the Cheleken brine, was made by evaporation. The purpose of this work was the comparison of behaviour of the new spontaneous fissioning nuclide with that of the known elements in the formation processes of the high concentration brines. Spontaneous fission of the nuclide was measured by means of the counters for multiple emission of neutrons. It is shown that the new spontaneous fissioning nuclide was enriched as well as other trace elements (Hg, Tl, Bi and Pb) in a solution remained after the evaporation of the initial solution. The conclusion is drawn that from the sea water brines could be obtained by evaporation which are enriched in trace elements with an enrichment degree higher than the natural brines.

38462 **(LA—9445-PNTX-H) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: geohydrologic investigations.** Purtymun, W.D.; Becker, N.M.; Maes, M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008067.

This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. Subsurface investigations were made to examine soil characteristics. Samples from test holes were analyzed for inorganic and organic chemicals, explosives, and radioactivity. Radiochemical analyses were also performed on surface and ground water, soil, and sediments in an adjacent to the Pantex Plant. Waste water and sediments from drainage ditches from the plant, ponded water and sediments from a playa basin, and sanitary effluent were examined for explosives and organic compounds.

38463 **(PNL—5041) Ground-water surveillance at the Hanford Site for CY 1983.** Prater, L.S.; Rieger, J.T.; Cline, C.S.; Jensen, E.J.; Liikala, T.L.; Oster, K.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 112p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84015127.

Operations at the Hanford Site have resulted in the discharge of large volumes of process cooling water and other waste waters to the ground. These effluents contain low level of radioactive and chemical substances. During 1983, 328 monitoring wells were sampled at various times for radioactive and chemical constituents. Three of these constituents, specifically tritium, nitrate, and gross beta activity, were selected for detailed discussion in this report because they are more readily transported in the ground water than some of the other constituents. Transport of these constituents in the ground water has resulted in the formation of plumes that can be mapped by contouring the analytical data obtained from the monitoring wells. This report describes recent changes in the configuration of the tritium, nitrate and gross beta plumes. Changes or trends in contaminant levels in wells located within both the main plumes (originating from the 200 Areas) and the smaller plumes are discussed in this report. Two potential pathways for radionuclide transport from the ground water to the environmental are discussed in this report, and the radiological impacts are examined. In addition to describing the present status of the ground water beneath the Hanford Site, this report contains the results of studies conducted in support of the ground-water surveillance effort during CY 1983. 21 references, 26 figures, 5 tables.

38464 **(TVA/PUB—84/53) Description of a program for calculating the radwaste dispersion of a slug release on HP-67 programmable calculators.** McCold, L. (Tennessee Valley Authority, Norris (USA). Div. of Water Resources). Feb 1978. 18p. NTIS, PC A02/MF A01. Order Number DE84901606.

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This technical not describes the use of a simple program for calculation of the dispersion of a slug release of tracer under riverine and run-of-the-river reservoir conditions. The program, called ILS HP-67, is designed to be used on an HP-67 programmable calculator. Neither the derivation of the mathematical expressions nor the limits of applicability are detailed. Program ILS HP-67 provides approximate far-field relative concentrations for a short duration release of liquid into a steadily flowing river. The release is assumed to consist of a quantity of liquid with some portion, called the tracer, being matter which is of concern. Herein, relative concentration is defined as the concentration of tracer in a sample of water divided by the concentration of tracer in the released liquid.

38465 **Radionuclide characterization, migration and monitoring at a commercial low-level waste disposal site.** Toste, A.P.; Kirby, L.J.; Rickard, W.H.; Robertson, D.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). pp 213-226 of Radioactive waste management. Vol. 5. Proceedings of an international conference held by the IAEA in Seattle, 16-20 May 1983. Vienna, Austria; IAEA (1984). (CONF-830523—; IAEA-CN—43/470). Contract AC06-76RL01830.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

One commercial low-level radioactive waste disposal facility is being studied to characterize the physico-chemical forms of the radionuclides and their behaviour during migration in groundwaters. Environmental monitoring studies are also in progress to identify and assess migration pathways of the radionuclides. At the Maxey Flats, Kentucky, low-level waste burial site, mobile species of various radionuclides have migrated short distances on-site (metres to tens of metres) from the trenches. Plutonium is migrating as a soluble anionic complex in the Pu(III) and Pu(IV) oxidation states. Empirical evidence suggests that ethylenediaminetetraacetic acid (EDTA) contained in the trench water has formed strong organic complexes with plutonium and ^{60}Co, thereby increasing their mobility. Mobile forms of ^{90}Sr and ^{137}Cs are associated with a variety of polar organic species, e.g. carboxylic acids. Environmental monitoring studies at the Maxey Flats site are assessing surface contamination and biological monitoring techniques that can be used for long-term surveillance. Deciduous forests growing near the Maxey Flats site offer the potential to detect the migration of radionuclides, particularly tritium, occurring by subterranean flow from the waste trenches if the flow is within the rooting depth of the trees.

5204 Thermal Effluents Monitoring And Transport

38466 **(DP—1686) Literature pertaining to thermally altered waters at SRP.** Wilde, E.W.; Mackey, H.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1984. Contract AC09-76SR00001. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014925.

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This report contains a listing of literature pertaining to each of the six major Savannah River Plant (SRP) aquatic systems receiving thermal effluent.

38467 **(EPRI-EA—3584) EPRI projects and publications on cooling-system effects on surface waters. Final report.** Marcus, M.D.; Bub, K.; Parkhurst, B.R. (Western Aquatics, Inc., Laramie, WY (USA)). Jun 1984. 78p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI84920459.

The Electric Power Research Institute (EPRI) has supported over 25 research projects, which have resulted in nearly 60 volumes of research reports, investigating effects of power plant cooling on surface waters and aquatic organisms. This report supplies an introduction to these projects and reports by providing an historical overview of the EPRI sponsored research projects and a general index to information contained in the reports. The general index consists of a bibliography for 58 annotated citations, which are indexed by: (1) contractors/authors; (2) keywords; (3) geographic locations and facilities; (4) taxonomic groups; and (5) research projects. The indexes provide direct access to pertinent information contained in the reports.

38468 **(TVA/ONR/WRF—84/5(a)) Aquatic environmental conditions in Chickamauga Reservoir during operation of Sequoyah Nuclear Plant. Third annual report, 1983.** Brown, R.T.; Bruggink, D.J.; Buchanan, J.P.; Dycus, D.L.; Smith, A.O.; Swor, C.T.; Tomljanovich, D.A.; Wade, D.C.; Wrenn, W.B. (Tennessee Valley Authority, Knoxville (USA). Div. of Air and Water Resources). Jun 1984. 329p. NTIS, PC A15/MF A01. Order Number DE84901616.

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Data analyses for this third monitoring program for water quality and aquatic ecosystem changes were similar to the first and second reports. Spatial alterations were determined by comparing upstream and downstream results. Temporal changes were compared with preoperational data. Program conclusions find no significant alteration of water quality as a result of operation. 74 references, 51 figures, 96 tables.

38469 **(TVA/ONR/WRF—84/5(b)) Aquatic environmental conditions in Chickamauga Reservoir during operation of Sequoyah Nuclear Plant. Third annual report, 1983. Appendices.** Brown, R.T.; Bruggink, D.J.; Buchanan, J.P.; Dycus, D.L.; Smith, A.O.; Swor, C.T.; Tomljanovich, D.A.; Wade, D.C.; Wrenn, W.B. (Tennessee Valley Authority, Knoxville (USA). Div. of Air and Water Resources). Jun 1984. 260p. NTIS, PC A12/MF A01. Order Number DE84901617.

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Twenty-eight appendices deal with the various water quality parameters.

38470 **(TVA/PUB—84/51) Effect of Sequoyah Nuclear Plant discharges on Chickamauga Lake water temperatures.** Ungate, C.D.; Howerton, K.A. (Tennessee Valley Authority, Norris (USA). Div. of Water Resources). Apr 1978. 60p. NTIS, PC A04/MF A01. Order Number DE84901597.

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The near-field effect of Sequoyah Nuclear Plant thermal discharges on Chickamauga Lake water temperatures is discussed. A description and performance characteristics of the plant's heat dis-

persal facilities, including the cooling water intake, discharge diffuser and cooling towers, are given. The use of the various facilities is described for open, helper and closed mode cooling of the plant. The expected temperature rise and maximum temperatures after diffuser-induced mixing in the Tennessee River are analyzed for the three basic modes of cooling. The use of particular modes during various river flow, river temperature and meteorological conditions is discussed. Compliance with State of Tennessee water temperature standards is evaluated and the mixing zone and water temperature monitoring requirements are discussed.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 52050037109, 38442

38471 **(AD-A—138450/2) Interim feasibility report and environmental impact statement for Oliver Lock replacement (BWT) Black Warrior-Tombigbee Rivers, Alabama. Revised. Final report.** (Corps of Engineers, Mobile, AL (USA). Mobile District). Dec 1983. 565p. NTIS, PC A24/MF A01.

Revision of report dated Jun 83.

A feasibility study to determine the desirability of replacing the 44 year old navigation Lock at Tuscaloosa, Alabama was conducted by the US Army Corps of Engineers. The 95 x 460 foot Lock chamber forces tow with more than 4 barges to double (separate the barges and Lock through in two segments). This procedure is time consuming with delays of 10 hours being experienced under present conditions. Trends confirm the increasing usage of the six barge tow thus traffic delays are expected to continue to rise. A simulation model was developed to analyze system impacts of a replacement Lock at Tuscaloosa. The model consisted of a series of inter-linked computer programs whose basic components were the Tow Cost Model and the Waterway Analysis Model. The systems analyzed the Black Warrior-Tombigbee River System, The Tennessee-Tombigbee Waterway, The Tennessee River, Gulf Intracoastal Waterway , Ohio River and Lower Mississippi River. Hydropower was analyzed for a run-of-river plant to be added to the new dam. The report has a main report section which is supported by appendices for Engineering, Design, and Cost; Economics; Environmental, and Pertinent Correspondence. The EIS is also contained within the volume.

38472 **(AD-A—140206/4) Installation Restoration Program (IRP). Phase I. Assessment of the potential for ground water contamination, Edwards Air Force Base Waste Disposal Site evaluations.** (Envirodyne Engineers, Inc., St. Louis, MO (USA)). 30 Apr 1981. 151p. NTIS, PC A08/MF A01.

Envirodyne Engineers, Inc. (EEI) evaluated the potential for ground water contamination at nine hazardous waste storage and disposal sites at Edwards Air Force Base, California. This evaluation consisted of an Initial Assessment Survey based on published and unpublished reports and records, interviews with base personnel, consultation with federal, state and local agencies, and site inspections. Five of the nine sites have little or no potential for ground water contamination. Two of the remaining four sites, the Industrial Waste Pond and the Main Base Toxic Waste Disposal Site, may have a limited potential for contamination of ground water. The remaining two sites, the North Lake Bed Storage and Disposal Site and the South Base Waste POL Storage Site, have significant potential to contaminate ground water. At the North Lake Bed site, two subsites are in physical environments which are susceptible to ground water contamination. Ground water contamination at these subsites needs to be verified and the wastes removed. At the South Base Waste POL Storage Area, ground water contamination may have already occurred or may occur in the future. Ground water in the immediate vicinity of this site should be monitored to detect contamination before it migrates.

38473 **(PB—84-149699) Water quality management program for Puget Sound. Part 2. Proposed approach and technical support effort.** (James and Stokes Associates, Inc., Bellevue, WA (USA)). Jan 1984. 154p. NTIS, PC A08/MF A01.

See also PB84-122266.

The Environmental Protection Agency and Washington Department of Ecology are developing a unified water quality management program for Puget Sound. This is the second of three reports addressing mangement needs and strategies.

38474 **(TVA/PUB—84/52) Natural thermal regime of Chickamauga Reservoir in the vicinity of Sequoyah Nuclear Plant.** Johnson, B.E.; Waldrop, W.R. (Tennessee Valley Authority, Norris (USA). Div. of Water Management). Feb 1978. 54p. NTIS, PC A04/MF A01. Order Number DE84901607.

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The natural regime of Chickamauga Reservoir in the vicinity of the Sequoyah Nuclear Plant prior to the operation of the plant was investigated. Historical records from permanent water temperature monitors defined the annual and diurnal temperature variations at specific positions in the reservoir near the plant. On-site boat surveys provided information relative to the diurnal cycle of the thermal structure and natural temperature variations of the reservoir during the spring and summer. The historical records of discharges from upstream and downstream hydro-electric plants revealed the range of monthly river flows and the duration of low river flows expected at the plant site.

5206 Regulations

REFER ALSO TO CITATION(S) 52060037510, 37759

38475 **(AD-A—140336/9) Navy electroplating pollution control technology assessment manual. Final report Feb-Aug 83.** Cushnie, G.C. Jr. (Centec Corp., Reston, VA (USA)). Feb 1984. 256p. NTIS, PC A12/MF A01.

The report provides information on more than 27 separate technologies encompassing conventional treatment, alternate treatment, material recovery techniques and processes and new plating bath formulations. In addition, the incorporation of a section on in-plant process changes enhances the usefulness of the product in that it highlights noncapital-intensive changes to current practices and/or processes that may have significant bearing on reducing overall chemical and water usage costs as well as consequent wastewater treatment needs and disposal costs. This document was prepared as a joint Air Force-Navy effort. It is intended to serve as a guide for technical personnel making decisions on an appropriate means of meeting effluent limits. The selection of any of the described technologies should be done only after a rigorous identification of site requirements has been performed.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 53010037752

38476 **(LA—9445-PNTX-J) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: socioeconomic assessment.** Rapp, D.A. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008069.

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This report documents work performed in support of preparation of an Environmental Impact Statement regarding the Department of Energy's Pantex Plant near Amarillo, Texas. The report addresses the socioeconomic tradeoffs associated with several different construction proposals at the Pantex Plant and at alternative locations in Iowa and Washington. The socioeconomic assessment provides the basis for comparison of impacts, if any, on the population of an area, its economy, governmental infrastructure, and various measures of quality of life. The economic implications of each proposed action have been described in terms of their potential effects on the local payrolls and retail sales within a geographical trade area.

38477 **Energy flow and the persistence of a human population: a simulation analysis.** Weinstein, D.A.; Shugart, H.H.; Brandt, C.C. (Univ. of Tennessee, Knoxville). *Human Ecology;* **11**: No. 2, 201-225(1983). Contract W-7405-ENG-26.

A human ecosystem model, NUNOA, simulates the yearly energy balance of individuals, families, and extended families in a hypothetical farming and herding community of Quechua Indians in the high Andes. The yearly energy demand of each family, based on the caloric requirements of its members, is computed by simulation of agricultural and herding activities in response to stochastic environmental conditions. The family energy balance is used in determining births, deaths, marriages, and resource sharing. The model user has the opportunity to investigate the effect of changes in marriage patterns, resource sharing patterns, or subsistence activities on the ability of the human population to survive in the harsh Andean environment. Results from the model suggest that the substructuring of a population into extended families provides a mechanism for sheltering the population from control by exogenous influences. A population without substructures for resource sharing is shown to be unstable in such an unpredictable environment.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 53020038471

38478 **(NUREG—1077) Environmental impact appraisal for renewal of Special Nuclear Material License No. SNM-21 (Docket No. 70-25).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jun 1984. 117p. NTIS, PC A06/MF A01 - GPO $5.00. Order Number TI84901299.

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The proposed action is the renewal of the license necessary for ESG to continue the existing Hot Laboratory operation in Building 020 at the Santa Susana site. The operations at the Headquarters facilities (Buildings 001 and 004) have ceased and the buildings are in the process of decontamination for unrestricted use. The operation of the plutonium R and D facilities (Building 055) at the Santa Susana site have ceased and Building 055 will be decontaminated for unrestricted use. The operations in Building 020 principally consist of the examination of irradiated reactor fuel and the preparation of irradiated Sodium Reactor Experiment (SRE) fuel for eventual reprocessing by removal of the metal cladding and thermal bonding material, cleaning and repackaging of the fuel slugs, and shipment of the fuel for reprocessing. Occasionally, unirradiated fuels are handled in the Hot Laboratory. When such ad hoc situations arise, ESG must receive specific approval from the NRC in the form of a license amendment. The types and amounts of special nuclear material to be handled under the renewed license are: (1) U-235 - 5 kg, contained in uranium or plutonium in various enrichments in any chemical or physical form (except UF_6); (2) Pu (principally Pu-239) - 2.0 kg in any chemical or physical form. Up to 2.0 kg Pu in irradiated fuel is to be used in the Hot Laboratory with less than 1.0 kg Pu in process; and (3) Pu (principally Pu-239) - 1.0 kg in sealed sources as Pu-Be sources. 28 references, 9 figures, 7 tables.

38479 **(NUREG—1078) Environmental impact appraisal for renewal of Special Nuclear Material License No. SNM-1097 (Docket No. 70-1113).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jun 1984. 82p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number TI84901300.

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The proposed action, the full 5-year renewal of License SNM-1097, is necessary for GE to continue producing fuel used in light-water nuclear reactors. The fuel manufacturing operation principally involves converting UF_6 to UO_2 powder, pressing the UO_2 powder into pellets, sintering and grinding the pellets, loading the pellets into Zircaloy tubes, and then assembling the loaded tubes into fuel bundles. A variety of radiological and nonradiological gaseous, liquid, and solid wastes are generated. After treatment, some of the wastes are released to the environment. In addition to the nuclear fuel fabrication operation, there are other operations performed at GE which do not require NRC licensing (e.g., zirconium metal processing, production of fuel bundle and mechanical reactor components, and the manufacture of aircraft engine parts) and are not associated with the proposed action. 28 references, 15 figures, 21 tables.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 55010038546

38480 **Numerical estimation of survival rates from band-recovery and biotelemetry data.** White, G.C. (Los Alamos National Lab., NM). *Journal of Wildlife Management;* **47**: No. 3, 716-728(1983).

The estimation of survival rates from tagging or banding data has been well developed by Brownie et al. However, problems occur when sparse data sets result in undefined estimates, when survival estimates exceed unity, when a hypothesis about the data cannot be tested by any of the available models, andwhen constraints on model estimators are desired. This paper presents a general analysis method whereby of the models Brownie et al. and many other methods described in the literature are merely special cases. Models are specified algebraically as cell probabilities consisting of functions of the survival rates and other parameters to be estimated. These algebraic expressions and the observed cell values are input to the computer program SURVIV to provide maximum-likelihood estimates of the unknown parameters and perform hypothesis tests on the data. The generality of the model specification also allows estimation of survival rates form biotelemetry data. 3 tables, 1 figure.

5502 Biochemistry

REFER ALSO TO CITATION(S) 55020038071, 38509, 38609, 38610, 38639

38481 **(BNL—34892) Measurement of Ca, Zn and Sr in enamel of human teeth by XRF.** Wielopolski, L.; Featherstone, J.D.B.; Cohn, S.H. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 9p. (CONF-840408—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014390.

From 5. international conference on nuclear methods in environmental and energy research; Mayaguez, Puerto Rico (2 Apr 1984).

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Energy dispersive x-ray fluorescence (EDXRF) has been employed to measure Ca, Zn, and Sr in enamel of human teeth. The calibration of the EDXRF system was performed by comparing Sr/Ca ratios with values obtained by atomic absorption analysis of acid etched biopsies of the enamel surface. Two calibration lines were obtained, one line for untreated teeth and the second line for teeth immersed (treated) in solutions containing Sr. A simple analytical model demonstrated that the two calibration lines were the result of the difference in the depth of the enamel sampled by EDXRF and by the acid-etched biopsy. The multi-elemental, nondestructive and quantitative aspects of EDXRF permit the sequential monitoring of the effects of Sr and Zn ions on the mineralization and demineralization processes in human enamel. The portability of the system and adaptability to non-invasive measurements makes it suitable for field studies. 26 references, 4 figures.

38482 **(DOE/ER/10665—1) Construction of genomic recombinant DNA clones. Progress report.** (North Carolina Univ., Chapel Hill (USA). Dept. of Zoology). 1983. Contract AS05-80ER10665. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014385.

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Progress is reported in the following research areas: (1) construction of genomic recombinant DNA clones; (2) in RNA isolation and characterization; (3) construction of recombinant cDNA clones; (4) isolation and characterization of CBH 1; and (5) isolation of the CBH II gene. (ACR)

38483 (DOE/ER/13107—2) Role of Ca^{2+} and calmodulin in phosphorylation of proteins in plants. Progress report. Cormier, M.J. (Georgia Univ., Athens (USA). Dept. of Biochemistry). 01 Jul 1984. Contract AS09-83ER13107. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014935.

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The goal was to provide an understanding, at the molecular level, of the in vitro requirements for Ca^{2+}-dependent protein phosphorylation in plant cells and to ascertain whether this Ca^{2+}-mediated phosphorylation represents one of the underlying mechanisms by which plants respond to external stimuli such as heat shock, growth regulators, etc. The first 10 months of this granting period resulted in (1) setting up a tissue culture system for growing soybean cells in large quantity from which protein kinases and their substrates may be isolated, (2) demonstrating the existence of Ca^{2+}-dependent protein kinases in extracts of these soybean cells, (3) demonstrating the presence of a number of endogenous substrates for these Ca^{2+}-dependent protein kinases, and (4) developing a rapid and sensitive assay for calmodulin. 4 figures, 3 tables.

38484 Spectrally distinct cytochrome b-563 components in a chloroplast cytochrome b-f complex: interaction with a hydroxyquinoline N-oxide. Clark, R.D.; Hind, G. (Brookhaven National Lab., Upton, NY). *Proceedings of the National Academy of Sciences of the United States of America;* **80**: 6249-6253(Oct 1983).

The two heme equivalents of cytochrome b-563 in the photosynthetic cytochrome b-f complex can be distinguished by their rate of reduction with dithionite at 25°C and by their optical absorption spectra at 77 K. The cytochrome b component that is rapidly reduced after addition of dithionite or reduced ferredoxin possesses an α band that splits at 77 K into two peaks, at 557 and 561 nm. Prolonged incubation with reductant reveals a second, approximately equimolar cytochrome b component that has at 77 K an unsplit α-band maximum at 561 nm. The designations cytochrome b-563/sub H/ and cytochrome b-563/sub L/, respectively, are proposed for the rapidly and more slowly reduced cytochrome b-563 components. Potentiometric titration establishes a midpoint potential, E/sub m/, of -30 mV (electron change $n \approx 2$) for cytochrome b-563/sub H/ and -150 mV ($n = 1$) for cytochrome b-563/sub L/ at pH 7.5. The reduction potential of these components is raised by 2-heptyl-4-hydroxyquinoline N-oxide, giving E/sub m/values of +57 and -34 mV, respectively, with each titration slope approximating $n = 2$.

38485 Neutrons and proteins. Schoenborn, B.P.; Raghavan, N.V. (Brookhaven National Lab., Upton, NY (USA)). pp 361-364 of Neutron and its applications, 1982. Plenary and invited papers from the conference to mark the 50th anniversary of the discovery of the neutron held at Cambridge, 13-17 September 1982. Schofield, P. (ed.). Bristol, England; Institute of Physics (1983). (CONF-820950—).

From Conference on the neutron and its applications; Cambridge, UK (13 Sep 1982).

Neutron diffraction studies of proteins have made important contributions to the understanding of the mechanism of protein functions. The experimental technique is briefly described and also its applications in determining protonation states of active sites and hydrogen-deuterium exchange in proteins in studies of enzymatic sites and protein dynamics

38486 Properties of liposomes containing ^{212}Pb. Rosenow, M.K.; Zucchini, G.L.; Bridwell, P.M.; Stuart, F.P.; Friedman, A.M. (Argonne National Lab., IL). *International Journal of Nuclear Medicine and Biology;* **10**: No. 4, 189-197(1983). Contract W-31-109-ENG-38.

The reverse phase evaporation method was used to prepare lipid bilayer membrane vesicles containing ^{212}Pb and other markers of high specific activity. Electron microscopy and microfiltration were used to measure the sizes of the liposomes. Isotopes were released from the liposomes during exposure to serum and this leakage was prevented by complexing of small molecules with proteins or by precipitating particulate complexes within the liposomes. The in vivo distribution of ^{212}Pb liposomes differed from the distribution of free ^{212}Pb in that the reticuloendothelial system cleared the liposomes. Liposomes with surface dinitrophenol hapten were highly immunogenic and the humoral response to dinitrophenol was nonspecifically suppressed by ^{212}Pb liposomes.

38487 Nuclease digestibility of chromatins is affected by nuclei isolation procedures. Prentice, D.A.; Gurley, L.R. (Los Alamos National Lab., NM). *Biochimica et Biophysica Acta;* **740**: 134-144(1983).

Experiments using nucleases as probes of chromatin structure take place in two stages: (1) nuclei isolation, and (2) nuclease digestion. The parameters of the nuclease digestion stage are usually strictly controlled because of nuclease sensitivity to them. However, there have been no reports on whether parameters in the nuclei isolation stage affect the subsequent nuclease digestions. The authors have evaluated a typical nuclei isolation technique with respect to how changes in the isolation parameters affect nuclease digestion kinetics. The authors observations point out that various parameters encountered in the nuclei isolation stage have a significant effect on the subsequent nuclease digestion kinetics of DNAase I. These parameters include the concentration of cells, divalent cations and phosphatase inhibitors. The pH, concentration of NaCl and concentration of detergent had little effect. Micrococcal nuclease was relatively unaffected by changes in the nuclei isolation parameters. The importance of this report lies in the demonstration that lack of control of seemingly insignificant parameters, such as cell concentration during the nuclei isolation stage, leads to subsequent irreproducible results in the DNAase I digestion. These findings indicate that great care must be exercised in the nuclei isolation stage if reproducible work is to be performed with DNAase I. The DNA of the cells was labelled with [^{14}C] thymidine.

38488 Inhibition of proton pumping in corn roots is associated with increased phosphorylation of membrane proteins. Zocchi, G.; Rogers, S.A.; Hanson, J.B. (Univ. of Illinois, Urbana). *Plant Science Letters;* **31**: 215-221(1983). Contract AC02-76EV00790.

Brief cold shock given to corn root tissue which has been preloaded with ^{32}P-labeled phosphate increases the phosphorylation of microsomal membrane proteins. Gel electrophoresis shows that discrete proteins are labeled. Preincubation of sealed microsomal vesicles under conditions producing membrane protein phosphorylation causes a 25% loss of total ATPase activity and 55% loss of uncoupler-sensitive activity. It is believed that the effect of injury or shock in blocking H^+ efflux pumping by corn roots may be attributed to phosphorylation of the H^+-ATPase. Calcium influx attending injury may be responsible for activating the protein kinase.

38489 Picosecond fluorescence kinetics in spinach chloroplasts at room temperature: effects of phosphorylation. Haworth, P.; Karukstis, K.K.; Sauer, K. (Univ. of California, Berkeley). *Biochimica et Biophysica Acta;* **725**: 261-271(1983). Contract AC03-76SF00098.

Single-photon timing with picosecond resolution was used to investigate the effect of phosphorylation on the fluorescence decay from broken spinach chloroplasts. Phosphorylation of spinach thylakoids causes a quenching of the slow decay phase (equivalent to a quenching of variable fluorescence) and an increase in the yield of the middle phase decay component. In addition, phosphorylation alters the intensity dependence of fluorescence in a manner which indicates a decreased antenna size of Photosystem II. The observed changes are indicative of a State 1-State 2 transition and show a clear reversal when the membranes are dephosphorylated.

38490 Picosecond fluorescence kinetic studies of electron acceptor Q redox heterogeneity. Karukstis, K.K.; Sauer, K. (Lawrence Berkeley Lab., CA). *Biochimica et Biophysica Acta;* **725**: 246-253(1983). Contract AC03-76SF00098.

The authors have investigated the influence of chloroplast organization on the nature of chemical reductive titrations of Photosystem II fluorescence decay kinetics in spinach chloroplasts. Structural changes of the chloroplast membrane system were induced by varying the ionic environment of the thylakoids. A single-photon timing system with picosecond resolution monitored the kinetics of the chlorophyll a fluorescence emission. At all ionic concentrations studied, the authors observed biphasic potentiometric ti-

tration curves of fluorescence yield; these have been interpreted to be suggestive of electron acceptor Q heteogeneity. A direct relation is observed between the E/sub m/ value of the low-potential component of Q and the Mg^{2+} concentration of the chloroplast suspending medium. The authors attributed these midpoint potential variations to the thylakoid structural rearrangements involved in cation-regulated grana stacking. Ionic effects on the fluorescence decay kinetics at the resox transition are discussed in terms of the heterogeneity of Photosystem II units (α- and β-centers) and the mechanism of deexcitation at a closed reaction center (fluorescence or nonradiative decay).

38491 **Peak-shape analysis for protein neutron crystallography with position-sensitive detectors.** Schoenborn, B.P. (Brookhaven National Lab., Upton, NY). *Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography;* **A39**: 315-321(1983).

In neutron protein crystallography, the use of position-sensitive detectors controlled by a modern data-acquisition system permits new approaches to data-collection strategies. Instead of dealing with conventional scans, like the theta-2theta scan, that provide an integrated intensity as a function of a rotational parameter, the computer-linked counter can be used to produce a three-dimensional reflection profile. As the crystal steps (Δ omega) through a reflection, the observed data for each step are stored in an external memory as a function of extent in 2theta and height (y) of a reflection. In this space, the reflection will be a three-dimensional distribution with dimensions determined by such basic geometrical conditions as $\Delta\lambda$, crystal size, mosaic spread, counter-resolution, and beam-collimation parameters. Knowledge of the interaction of these basic parameters will allow the design of optimal beam optics and will permit the delineation of the reflection from the background and permit, therefore, an accurate intensity determination.

38492 **Histone fractionation by high-performance liquid chromatography on cyanoalkylsilane (CN) reverse-phase columns.** Gurley, L.R.; Prentice, D.A.; Valdez, J.G.; Spall, W.D. (Los Alamos National Lab., NM). *Analytical Biochemistry;* **131**: 465-477(1983).

Previous work described conditions for the rapid fractionation of histones by high-performance liquid chromatography (HPLC) using a reverse-phase μBondapak C_{18} column. That procedure resolved the major classes of histones with one exception: the more hydrophobic H2A variant, (MHP)H2A, was not resolved from the H4 histone class. This report extends that work describing experiments using a μBondapak CN column which better resolves the classes of histones from each other including the resolution of (MHP)H2A from the H4. In addition, the less hydrophobic H2A variant, (LHP)H2A, is partially resolved from the (MHP)H2A, and the less hydrophobic H3 variant, (LHP)H3, is resolved from the more hydrophobic H3 variant, (MHP)H3. Lower trifluoroacetic acid (TFA) concentrations (0.1%) in the eluting water/acetonitrile solvent were used with the CN column than were used with the C_{18} column which increased the sensitivity of histone detection by ultraviolet absorption at 206 nm. Greater than 95% of the total [^{3}H]lysine-labeled protein applied to the CN column was eluted from the column. Contaminating nonhistone proteins were found to chromatograph in the region of histone elution. These were greatly reduced by isolating nuclei prior to histone preparation. The fractionation of the histones appears to be based on the hydrophobic properties of the proteins. The histone fractions (identified by their electrophoretic mobilities) were eluted from the CN column in the following order: H1, H2B, (LHP)H2A, (MHP)H2A, H4, (LHP)H3, and (MHP)H3. Phosphorylated and acetylated histone species were not resolved from their unmodified parental species.

38493 **Terpenes from Pittosporaceae.** Nemethy, E.K.; Calvin, M. (Univ. of California, Berkeley). *Phytochemistry;* **21**: No. 12, 2981-2982(1982). Contract W-7405-ENG-48.

The monoterpenes of the fruits of Pittosporum resiniferum and P. undulatum have been identified. The essential oil of P. resiniferum contains myrcene and α-pinene in equal quantities, whereas the major terpene of P. undulatum oil is limonene.

38494 **New cadinene derivatives from Heterotheca latifolia.** Bohlmann, F.; Gupta, R.K.; King, R.M.; Robinson, H. (Technical Univ. of Berlin, West Germany). *Phytochemistry;* **21**: No. 12, 2982-2984(1982).

So far five species of the North American genus Heterotheca have been investigated chemically [1-3]; however, in only three species have the aerial parts been investigated. The authors have now studied the aerial parts of H. latifolia. Heterotheca latifolia afforded several new acids all derived from cadinane.

38495 **Specific antiserum staining of two-dimensional electrophoretic patterns of human plasma proteins immobilized on nitrocellulose.** Anderson, N.L.; Nance, S.L.; Pearson, T.W.; Anderson, N.G. (Argonne National Lab., IL). *Electrophoresis (Weinheim, Federal Republic of Germany);* **3**: 135-142(1982). Contract W-31-109-ENG-38.

Human plasma proteins separated by high-resolution two-dimensional electrophoresis have been electrophoretically transferred to sheets of nitrocellulose. Although the proteins have been denatured in sodium dodecyl sulfate and separated into subunits, the nitrocellulose-bound molecules still react with appropriate specific antisera even after storage of the tranfer in air at room temperature for 5 months. Of 25 proteins whose location in the pattern had been previously determined, 24 are specifically revealed on transfers of whole plasma patterns by appropriate antiserum. It therefore seems likely that a large majority of proteins (>96% in this study) retain sufficient conformation throughout the analytical procedure (or can regain it easily afterwards) to be recognized immunologically. Of three monoclonal antibodies similarly tested, none could detect antigen transferred to nitrocellulose from a two-dimensional gel, while each bound specifically to the appropriate antigen absorbed in native form to the nitrocellulose.

38496 **Partial sequence determination of metabolically labeled radioactive proteins and peptides.** Anderson, C.W. (Brookhaven National Lab., Upton, NY). pp 147-167 of Genetic engineering. Volume 4. Setlow; Hollaender (eds.). New York, NY; Plenum Publishing Corp. (1982). Contract AC02-76CH00016.

The author has used the sequence analysis of radioactive proteins and peptides to approach several problems during the past few years. They, in collaboration with others, have mapped precisely several adenovirus proteins with respect to the nucleotide sequence of the adenovirus genome; identified hitherto missed proteins encoded by bacteriophage MS2 and by simian virus 40; analyzed the aminoterminal maturation of several virus proteins; determined the cleavage sites for processing of the poliovirus polyprotein; and analyzed the mechanism of frameshifting by excess normal tRNAs during cell-free protein synthesis. This chapter is designed to aid those without prior experience at protein sequence determinations. It is based primarily on the experience gained in the studies cited above, which made use of the Beckman 890 series automated protein sequencers.

38497 **(LA-tr—84-17) Determination of urinary phenol by means of HPLC.** Berri, A.; Ghittori, S. Translated from *Giornale Italiano di Medicina del Lavoro ;* **4**: No. 4-5, 235-236(1982). Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015059. DE84015059

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The article describes a method to determine urinary phenol by using HPLC with the addition of a spectrofluorometer as a detector. The response is linear for quantities of phenol that are elevated by a factor of as much as 5. The detection limit is 20 pg, which corresponds to a minimum quantity of urinary phenol equal to 0.5 mg/1. 8 references, 2 figures.

38498 **Rotary shadowing of extended molecules dried from glycerol.** Tyler, J.M.; Branton, D. (Harvard Univ., Cambridge, MA). *Journal of Ultrastructure Research;* **71**: 95-102(1980). Contract AC02-76EV02423.

A convenient technique for shadowing extended flexible molecules difficult or impossible to visualize after conventional preparative methods is described. The technique uses glycerol but

avoids other harsh conditions; physiological salt concentrations can be maintained until the moment of drying.

5503 Cytology

REFER ALSO TO CITATION(S) 55030038498, 38611

38499 **Photosynthetic membrane development studied using picosecond fluorescence kinetics.** Karukstis, K.K.; Sauer, K. (Univ. of California, Berkeley). *Biochimica et Biophysica Acta;* **725**: 384-393(1983). Contract AC03-76SF00098.

Using measurements of the kinetics of chlorophyll a fluorescence emission, the development of the photosynthetic membrane during etioplast-to-chloroplast differentiation was investigated. Tthe chlorophyll fluorescence decay kinetics of pea chloroplasts from plants grown under intermittent (2 min light-118 min dark) and continuous light regimes were monitored with a single-proton timing system with picosecond resolution. The changes in the fluorescence yields and decay kinetics were associated with known structural and organizational developmental phenomena in the chloroplast. This correlation provides a more detailed assignment of the origins of the fluorescence decay components than has been previously obtained by studying only mature chloroplasts. In particular, the analysis of the variable kinetics and multiexponential character of the fluorescence emission during thylakoid development focuses on the organization of photosynthetic units and the degree of communication between reaction centers in the same photosystem. These results further demonstrate that the age of etiolated tissue is critical to plastid development.

38500 **Structural analysis of the surface-layer protein of spirillum serpens by high-resolution electron microscopy.** Wu, W.H.; Glaeser, R.M. (Univ. of California, Berkeley). *Proceedings - Annual Meeting, Electron Microsopy Society of America;* **41**: 738-739(1983). Contract AC03-76SF00098.

In order to understand the detailed association of the macromolecules of the structure of the protein, a high resolution structural analysis was performed. Large, single layered arrays of the surface layer protein have been obtained for this purpose by means of extensive heating in high $CaCl_2$. The computer processed image reveals a pore of about 10 Angstrom diameter at the 6-fold symmetry center; the handedness of the images is quite evident. The individual molecular envelope of the protein monomers are apparent and details of the protein-protein contact at the three-fold lattice positions emerge.

38501 **Structural anomalies of highly malignant respiratory tract epithelial cells.** Manger, R.L.; Heckman, C.A. (Oak Ridge National Lab., TN). *Cancer Research;* **42**: 4591-4599(Nov 1982). Contract W-7405-ENG-26.

These studies were designed to determine whether cytostructural changes were related to malignancy and the loss of growth control in epithelial cells. Three highly malignant cell lines were derived from transplantable carcinomas of the respiratory tract and compared with three respiratory tract epithelial lines of negligible malignancy. Keratin cytoskeletons were visualized by indirect immunofluorescence staining, and sample photomicrographs representing each line were prepared. The criteria used in making the classifications to identify the features common to the highly malignant lines included the nonuniform spacing of cells in the field of view, the cell shape, and the presence of nonfluorescent areas in the lamellar cytoplasm. Since the nonuniformity of keratin distribution in the periphery of the malignant cells suggested a structural anomaly, the cell lines were also examined by scanning electron microscopy. Unlike cells from the lines of negligible malignancy, cells from two of the highly malignant lines showed thickenings in the subterminal portions of the lamellar cytoplasm. The results suggested that specific architectural changes at the cellular level might be linked to the process of epithelial transformation and tumor progression.

38502 **Technique for estimating phytoplankton division rates by using a DNA-binding fluorescent dye.** Falkowski, P.G.; Owens, T.G. (Brookhaven National Lab., Upton, NY). *Limnology and Oceanography, Supplement;* **27**: No. 4, 776-782(1982). Contract AC02-76CH00016.

Phytoplankton division rates were estimated by following time-course changes in DNA using a DNA-specific fluorescent dye. The method is simple, inexpensive, and rapid. A technique using a light bottle minus dark bottle method is described for estimating division rates of phytoplankton samples in natural waters.

38503 **Principles, relative merits, and limitations of current cytokinetic methods.** Mendelsohn, M.L. (Lawrence Livermore Lab., CA). pp 101-112 of Growth kinetics and biochemical regulation of normal and malignant cells. Drewinko, B.; Humphrey, R.M. (eds.). Williams and Wilkins Co.; Baltimore,MD (1977). Contract W-7405-ENG-48.

A methods-oriented overview of cell cycle analysis is presented. The key points of the methods are presented in eight diagrams. Methods included are fraction of labeled mitosis (FLM or PLM), labeling and mitotic indices, growth fraction, cell loss rate, single DNA distribution, mulitple DNA distributions, and harvested M and S cells. (JMT)

38504 **Satellite DNA and cytogenetic evolution: molecular aspects and implications for man.** Hatch, F.T.; Mazrimas, J.A. (Univ. of California, Livermore). pp 395-414 of Human cytogenetics: ECN-UCLA symposia on molecular and cellular biology. Vol. 7. New York, NY; Academic Press, Inc. (1977). Contract W-7405-ENG-48.

The genus of kangaroo rats (Dipodomys) exhibits remarkable interspecies variations in content of three satellite DNAs, consisting of simple sequences 3 to 10 base pairs long, and in species karyotypes. A broad range of diploid-DNA content is correlated with satellite-DNA content. The latter is correlated positively with predominance of biarmed over uniarmed chromosomes (high fundamental number FN) and inversely with two anatomical indices (legbone-length ratios) of specialization for the jumping gait. Karyotypic variation is achieved via chromosomal rearrangements, e.g., Robertsonian fusion, C-band heteromorphism, and pericentric inversion. Environmental adaptation is achieved, in part, by reassortment of gene-linkage groups and regulatory controls as a result of the chromosomal rearrangements. The foregoing relationships suggest that highly reiterated DNA sequences play a supragenic, global role in environmental adaptation and the evolution of new species. (JMT)

38505 **Hybridization in situ of ^{125}I-cRNA transcribed from sorted metaphase chromosomes.** Sawin, V.L.; Scherberg, N.; Carrano, A. (Univ. of Chicago, IL). pp 271-282 of Human cytogenetics: ICN-UCLA symposia on molecular and cellular biology. Vol. 7. New York, NY; Academic Press, Inc. (1977).

Preliminary data is presented on the use of sorted chromosomes in the analysis of sequence homologies among the chromosomes of a single species. The fourteen morphologically distinct chromosomes of the Chinese hamster cell line M3-1 can be resolved by a flow microfluorimeter into nine groups (peaks) on the basis of DNA content. The chromosomes of a single peak can be separated from the remainder by an electronic cell sorter. For the present experiments, the DNA of 10^6 Peak A chromosomes (95% pure Chinese hamster chromosome #1) was denatured and purified by gradient sedimentation. ^{125}I-cRNA was transcribed from Peak A chromosome DNA or from whole Chinese hamster or E. coli DNA in an RNA polymerase reaction mixture containing carrier-free ^{125}I-CTP. Each cRNA was hybridized in situ to Chinese hamster cells, and its chromosomal location was determined by autoradiography. The transcript from E. coli DNA showed no hybridization to Chinese hamster chromosomes, whereas that from Chinese hamster DNA hybridized extensively over the entire genome. When the DNA from Chinese hamster Peak A chromosomes was used as template, the ^{125}I-cRNA again hybridized to numerous sites throughout the Chinese hamster genome. Values of C/sub r/t for the hybridization reactions were between 10^{-3} and 4×10^{-3} mole sec l^{-1} suggesting that the sites of hybridization represent highly reiterated sequences common to all the chromosomes.

5504 Genetics

38506 **(DOE/ER—0147/1) Annual report and summaries of FY 1983 activities supported by the Division of Biological Energy Research.** Rabson, R. (USDOE Office of Energy Research, Washington, DC. Biological Energy Research Div.). Oct 1983. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015328.

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Summaries of research performed in FY 1983 are presented. Representative research areas include: (1) progress was made in modifying the Agrobacterium tumefaciens Ti plasmid as a vector in the transfer of DNA in higher plants. The plasmid was disarmed by genetically altering that information which is responsible for unwanted tumor formation in recipient plants. In addition it was demonstrated that antibiotic resistance as a representative genetic character may be transferred by the Ti plasmid to a recipient plant culture; (2) by using appropriately constituted genetic lines of maize it has been possible by following male sterility restorer function to measure for the first time the frequency and character of genetic transposition events in a higher organism; (3) the gene coding for susceptibility to the herbicide atrazine in higher plants has been identified, cloned, and sequenced. A mutant gene which is responsible for resistance to the herbicide has likewise been studied. The difference between the two is one nucleotide in the DNA sequence; and (4) amino acid sequences of a number of proteins of the smallest functional photosynthetic particle, known as the reaction center, of the photosynthetic bacterium Rhodopseudomonas capsulata have been determined by cloning and sequencing the corresponding DNA. This information has led to new insights concerning the structural and functional nature of the proteins in photosynthesis.

38507 **Control of mammalian sex ratio by sexing sperm.** Gledhill, B.L. (Lawrence Livermore National Lab., CA). *Fertility and Sterility;* **40**: No. 5, 572-574(Nov 1983). Contract W-7405-ENG-48.

Preselection of sex is discussed with emphasis on methods which have claimed success in separating X- and Y-chromosome-bearing sperm. Much of the recent experimental work in separating human X and Y sperm judges the success of enrichment solely by staining for the Y sperm with a quinacrine dye, which causes a bright fluorescence of the long arm of the Y chromosome. This method is questioned because the endpoint may be producing spurious results. Flow sorting is believed to be the first verified separation of mammalian sperm, but the sperm were nonviable. Flow cytometry can be used to quickly determine the success of other enrichment techniques. Bulk separation, as contrasted to separation based on determination of individual sperm characteristics, with 80% enrichment seems to be a reasonable future goal.

38508 **Novel sequence segment and other nucleotide structural features in the long terminal repeat of a BALB/c mouse genomic leukemia virus-related DNA clone.** Ou, C.Y.; Boone, L.R.; Yang, W.K. (Univ. of Tennessee, Oak Ridge). *Nucleic Acids Research;* **11**: No. 16, 5603-5620(1983). Contract W-7405-ENG-26.

A recombinant DNA clone, named AL10, that contains murine leukemia virus (MuLV) related sequences was isolated from BALB/c mouse chromosomal DNA and examined in detail. Restriction endonuclease mapping revealed that the 10.5 kbp EcoRI insert consists of a 3.6 kbp left flanking cellular DNA region and a 6.9 kbp MuLV-related region that has a typical proviral LTR-gag-pol-env structure up to the EcoRI site in the env gene region. Comparison of the AL10 map with ecotropic and xenotropic virus isolates revealed many common restriction sites in the LTR and pol gene regions, but much fewer in the leader and gag regions. A stretch of 1,700 nucleotides containing the cell-provirus junctional region was sequenced and revealed transcriptional consensus signals and other structural features characteristic of MuLV LTRs, as well as two distinctive features: (a) a sequence of ~170 bp with direct and inverted terminal repeats not seen in infectious MuLV LTRs was identified in the U3 region between the enhancer region and the CAT box. This novel segment or its homologous sequences appear to be present in most of the endogenous MuLV-related LTRs and in other chromosomal locations of the mouse (b) The tRNA primer binding site is not complementary to proline tRNA, the primer for all known MuLVs, but is a 17/18 match with rat glutamine tRNA. The integration site of AL10 provirus was in a unique DNA region but contained an Alu-like short interdispersed repeat in the 5′ adjacent cellular region. The AL10 proviral integration found in BALB/c was also apparent in RFM, AKR and SENCAR mouse cells but not in cells of NFS/N, C3H, HRS/J, SC-1, and a California Lake Casitas wild mouse.

5505 Metabolism

38509 **(DOE/ER/12087—T1) Proton pumping in purple membrane. Appendix I. Progress report.** (Department of Energy, Chicago, IL (USA). Chicago Operations Office). 1984. Contract AC02-82ER12087. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014601.

Research progress is reported on studies of the relationship between the structure of purple membrane, its light-activated conformational changes, and the physiological action of light - the creation of an energy gradient by the movement of protons across the cell membrane. (ACR)

38510 **(GSF-BT—789) Moessbauer studies of the molybdenum-iron-protein in the nitrogenase of Xanthobacter autotrophicus GZ 29.** Rottgardt, K.A.D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). May 1983. 148p. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig, Germany, F.R., Inst. fuer Tieflagerung. Order Number TI84751940.

Biological cells of the nitrogen fixating bacteria Xanthobacter autotrophicus GZ 29 have been cultivated with 57-Fe, and from the nitrogenase of these cells the 57-Fe marked molybdenum-iron-protein is extracted. The Moessbauer spectra of this enzyme show that the structure of the iron cluster is similar to the structure in the molybdenum-iron-proteins of Azotobacter vinelandii, Klebsiella pneumoniae or Clostridium pasteurianum.

5506 Medicine

REFER ALSO TO CITATION(S) 55060038268, 38568, 38569, 38570, 38571, 38574, 38575, 38576, 38577, 38578, 38579, 38581, 38582, 38583

38511 (INIS-BR—121, pp 156) **Dose distribution near perspex-aluminium - and perspex-cork interfaces irradiated with ^{60}Co and 8MV X-ray.** Freitas, Lea C. de. 1983. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780533. (CONF-8308170—).

From Meeting on medical physics in Rio de Janeiro; Rio de Janeiro, Brazil (25 Aug 1983).

38512 (INIS-BR—121, pp 156) **Dosimetry of a Fletcher-Euclides type gynecologic applicator.** Pereira, A.J.; Costa, R.N.; Correa, E.M. (CLINRAD, Sao Paulo (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780533. (CONF-8308170—).

From Meeting on medical physics in Rio de Janeiro; Rio de Janeiro, Brazil (25 Aug 1983).

38513 (INIS-BR—121, pp 156) **Thermoluminescent dosimetry in brachytherapy with ^{192}I.** Morales, F.C.; Fujisawa, S. (Instituto de Radioterapia de Sao Paulo (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780533. (CONF-8308170—).

From Meeting on medical physics in Rio de Janeiro; Rio de Janeiro, Brazil (25 Aug 1983).

38514 (INIS-BR—121, pp 156) **Dose conversion factors in brachytherapy.** Briquet, C.; Bertelli Neto, L.; Souhami Filho, L.; Almeida, C.E. de (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1983. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780533. (CONF-8308170—).

From Meeting on medical physics in Rio de Janeiro; Rio de Janeiro, Brazil (25 Aug 1983).

38515 (INIS-BR—121, pp 156) **Use of radiopaque substances in radiotherapy.** Santos-Mello, R. (Brasilia Univ. (Brazil). Inst. de Biologia). 1983. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780533. (CONF-8308170—).

From Meeting on medical physics in Rio de Janeiro; Rio de Janeiro, Brazil (25 Aug 1983).

38516 (INIS-BR—121, pp 156) **Construction of a collimator for ventricular function studies.** Piva, R.M.V.; Robilotta, C.C. 1983. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780533. (CONF-8308170—).

From Meeting on medical physics in Rio de Janeiro; Rio de Janeiro, Brazil (25 Aug 1983).

38517 (INIS-mf—8978, pp 69) **Computer densitometry of kidneys.** Heuck, F.H.W.; Reiser, U. (Katharinenhospital, Stuttgart (Germany, F.R.). Zentral-Roentgeninstitut). 1981. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38518 (INIS-mf—8978, pp 84-85) **What are the benefits of computer tomography in diagnosis of tumours in the oral, mandibular and facial region.** Jend, H.H.; Jend-Rossmann, I. (Hamburg Univ. (Germany, F.R.). Radiologische Klinik und Strahleninstitut); Heller, M. (Nordwestdeutsche Kieferklinik, Hamburg (Germany, F.R.)); Hagemann, J. (Hamburg Univ. (Germany, F.R.). Universitaets-Krankenhaus Eppendorf). 1981. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38519 (INIS-mf—8978, pp 93) **Studies of computerized tomography (CT) in adults, adolescents and children with psychiatric diagnoses.** Kohlmeyer, K. (Central Institute of Mental Health, Mannheim (Germany, F.R.)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38520 (INIS-mf—8978, pp 108) **CT diagnosis of gliomas and their rational therapy.** Kvicala, V. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). 1981. (In Czech). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38521 (INIS-mf—8978, pp 113) **Experiences with computed tomographic guided fine-needle aspiration biopsy.** Liess, G.; Luening, M. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38522 (INIS-mf—8978, pp 161) **Application of computed tomography in the evaluation of soft tissue tumors and bone tumors.** Rotte, K.H.; Schmidt-Peter, P.; Kreidemann, E.; Koenig, W. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38523 (INIS-mf—8978, pp 158) **Our first experience with CT diagnostics in abdominal diseases.** Sehr, A.; Jirasek, M.; Bruna, J.; Cermak, F. (Karlova Univ., Prague (Czechoslovakia). Lekarska Fakulta Hygienicka). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38524 (INIS-mf—8978, pp 173) **Computed tomography of the urinary bladder and prostate.** Smulewicz, J.J. (Beth Israel Hospital, New York (USA)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38525 (INIS-mf—8978, pp 52) **Complex use of radiodiagnostic and ultrasonographic methods in effective diagnosis of pancreatic and hepatic tumors.** Grekov, P.; Mersten, A.; Kriegerova, K.; Zimacek, J; Lakata, E.; Hildebrand, T.; Rod, J. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Lekarska Fakulta). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38526 (INIS-mf—8978, pp 92) **Radiodiagnostic possibilities in complications of hip joint prostheses.** Kolar, J.; Sprindrich, J.; Zidkova, H.; Slavik, M.; Konopasek, B. (Institut pro Dalsi Vzdelavani Lekaru a Farmaceutu, Prague (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38527 (INIS-mf—8978, pp 41) **Megavoltage radiotherapy in the management of lymph node metastasis in head and neck cancer.** Dimitrovska, A.; Velkov, K.; Jovanovski, D.; Evtimovski, M.; Nikolova, L. (Institute of Radiotherapy and Oncology, Skopie (Yugoslavia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38528 (INIS-mf—8978, pp 45) **Dose-fractionation and results of radiotherapy in larynx carcinoma.** Durkovsky, J.; Sevcikova, L. (Ustav Klinickej Onkologie, Bratislava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38529 (INIS-mf—8978, pp 46) **Problem of radiotherapy of malignant pharyngeal neoplasms.** Eberhardt, H.-J.; Toelle, D. (Medizinische Akademie, Dresden (German Democratic Republic). Radiologische Klinik). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38530 (INIS-mf—8978, pp 91) **Experience with combined methotrexate and radiotherapy in the treatment of oropharyngeal carcinomas.** Klimo, J.; Kulikova, M.; Jelenova, A.; Koperdanova, V. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Lekarska Fakulta). 1981. (In Slovak). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38531 (INIS-mf—8978, pp 95) **Our approach to and the results of therapy of pharyngeal carcinoma.** Konecny, M.; Pecina, J.; Rasovska, O. (Research Institute of Clinical and Experimental Oncology, Brno (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38532 (INIS-mf—8978, pp 160) **Results of radiation treatment of renal tumours.** Roeder, K.; Mueller, H.-W.; Kaiper, G.; Kammerer, R.; Michael, G. (Medizinische Akademie, Magdeburg (German Democratic Republic)). 1981. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38533 (INIS-mf—8978, pp 171) **First results of fast neutron therapy for advanced head and neck cancer in Krakow.** Skolyszewski, J. (Instytut Onkologii, Krakow (Poland)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38534 (INIS-mf—8978, pp 213) **Vascularization in carcinoma and its importance for radiation response.** Siracka, E.; Siracky, J.; Pappova, N. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Vyskumny Ustav Onkologicky). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38535 (INIS-mf—8978, pp 66) **Computer tomography of mediastinum and lung.** Heger, L.; Vacek, Z.; Elias, J.; Simek, J.; Prochazka, E; Kral, B. (Karlova Univ., Hradec Kralove (Czechoslovakia). Lekarska Fakulta). 1980. (In Czech). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38536 **Detection of ocular melanoma with 4-(3-dimethylaminopropylamino)-7-[^{123}I]-iodoquinoline.** Lambrecht, R.M.; Packer, S.; Wolf, A.P.; Lloyd, D.; Atkins, H.L. (Brookhaven National Lab., Upton, NY). *Journal of Nuclear Medicine;* **25**: No. 7, 800-804(Jul 1984).

Iodine-123-labeled 4-(3-dimethylpropylamino)-7-iodoquinoline was evaluated in nine patients. By using a specially designed dual-pinhole ocular collimator, it was possible to obtain positive images at 2-6 hr for only 70% of the cases with subsequently proven ocular melanomas.

38537 **Pion treatment procedures and verification techniques.** Zink, S.R.; Bush, S.E.; Gilman, C.J.; Hilko, R.H.; Justice, R.K.; Osborne, E.C.; Smith, A.R.; Berardo, P.A. (Univ. of New Mexico, Albuquerque). *International Journal of Radiation Oncology, Biology and Physics;* **10**: No. 5, 723-735(May 1984).

Procedures and techniques developed for the negative pi-meson (pion) radiotherapy program at the Los Alamos Meson Physics Facility, Los Alamos, NM, are reviewed and described. A particular pion patient is followed through the entire planning and treatment sequence to describe CT scanning procedures, bolus and collimator and treatment techniques developed to minimize positioning errors (less than 5 mm). Comparison of 2-D and 3-d isodose calculation developed at Los Alamos showed differences of less than 10% attributable to multiple scattering effects and the computational models used. Treatment verification methods using in vivo ion chamber dosimetry generally confirmed the prescribed dose delivery within 10% and using TLD within 18%.

38538 **Reconstruction filters for 3-D NMR tomography with planar integrals.** Nalcioglu, O.; Cho, Z.H. (Depts. of Radiological Sciences, Electrical Engineering and Cardiology, Univ. of California, Irvine, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 553-555(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

Reconstruction filters for 3-D NMR tomography with planar projections are discussed. In 3-D tomography with planar projections, the mathematical reconstruction filter in the time domain is equal to the square of time variable. Two generalized filter functions are introduced. Simulation results comparing these filters are presented.

38539 **A statistical analysis of count normalization methods used in positron-emission tomography.** Holmes, T.J.; Ficke, D.C.; Snyder, D.L. (Institute for Biomedical Computing, Department of Electrical Engineering, and Mallinckrodt Institute of Radiology, Washington University, St. Louis, Missouri 63110). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 521-526(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

As part of the Positron-Emission Tomography (PET) reconstruction process, annihilation counts are normalized for photon absorption, detector efficiency and detector-pair duty-cycle. Several normalization methods of time-of-flight and conventional systems are analyzed mathematically for count bias and variance. The results of the study have some implications on hardware and software complexity and on image noise and distortion.

38540 **Inversion for the attenuated radon transform with constant attenuation.** Kim, K.I.; Bizais, Y.; Rowe, R.W.; Tewarson, R.P. (Brookhaven Nat'l. Lab., Upton, NY, and S.U.N.Y. at Stony Brook, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 538-542(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

An exact form of the inversion formula for the attenuated Radon transform with constant attenuation in a convex domain for use in Single-Photon Computerized Tomography is presented. This problem is reduced to solving a generalized Abel integral equation and the conditions for the existence of a unique continuous solution are given. Implementation of this method involves a preprocessing step (modified attenuated Radon transform), a convolution by an attenuation-dependent function and a weighted backprojection. Therefore, only slight modifications of existing reconstruction algorithms are needed. If the attenuation is zero, this formula reduces to Radon's original inversion formula. When attenuation is not constant, the conditions for a unique continuous solution can be established with a similar approach. Many results found empirically by previous authors are consistent with this theory.

38541 **Utilizing side information in emission tomography.** Snyder, D.L. (Dept. of Electrical Engineering and Inst. for Biomedical Computing, Washington Univ., St. Louis, MO 63130). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 533-537(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

Anatomical information derived from x-ray and NMR tomographic sections is useful for producing more accurate reconstructions of radioactivity distributions in the same section from emission-tomography data. Additionally, attenuation information acquired for calibration in emission tomography is necessary for producing accurate reconstructions of activity. An algorithm based on the maximum-likelihood method of statistics is identified for utilizing both of these forms of side information in emission-tomography systems.

38542 **Interactions of collimation, sampling and filtering on spect spatial resolution.** Tsui, B.M.W.; Jaszczak, R.J. (Department of Radiology and Curriculum in Biomedical Engineering University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 527-532(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The major factors which affect the spatial resolution of single-photon emission computer tomography (SPECT) include collimation, sampling and filtering. A theoretical formulation is presented to describe the relationship between these factors and their effects on the projection data. Numerical calculations were made using commercially available SPECT systems and imaging parameters. The results provide an important guide for proper selection of the collimator-detector design, the imaging and the reconstruction parameters to avoid unnecessary spatial resolution degradation and aliasing artifacts in the reconstructed image. In addition, the understanding will help in the fair evaluation of different SPECT systems under specific imaging conditions.

38543 **Characteristics of small barium fluoride (BaF) scintillator for high intrinsic resolution time-of-flight positron emission tomography.** Wong, W.H.; Bristow, D.; Hartz, R.H.; Mulani, N.A.; Wardworth, G. (Univ. of Texas Medical School at Houston, Division of Cardiology, 6431 Fannin, Houston, TX 77025). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 381-386(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The implementation of BaF_2 for high spatial and TOF resolution PET cameras has been investigated. Intrinsic characteristics relating to the exclusive use of its fast 220 nm component, such as self-absorption, reflection material, optical coupling, energy resolution, timing resolution, number of fast photons, photofractrion, coincidence efficiency, and photomultiplier are presented. Extrinsic characteristics such as intrinsic spatial resolution variation with radius, the need for tungsten partition and the optimization of detector ring radius and tungsten partition thickness were investigated. Schemes of using multiple scintillators on a single PMT due to the absence of small PMT with small transit time spread and economic reasons are also presented.

38544 **Influence of the depth effect on quantitative results in single photon emission tomography with attenuation correction.** Pergrale, J.; Berche, C.; Iachetti, D.; Jatteau, M.; Normand, G. (LEP, 3, Avenue Descartes, 94450 Limeil - Brevannes). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 516-520(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A study has been carried out in order to assess the influence of the solid angle effect during the scintigraphic images acquisition (depth effect), on the transverse sections reconstructed with 9 different techniques of attenuation correction. A numerical phantom of the abdomen, generated with auto-attenuation and with or without depth effect has been used. This depth effect was simulated from experimental data. The results show that the depth effect, modifying the reconstruction results has to be taken into account for the evaluation of attenuation correction techniques.

38545 **Experience with a FASTBUS based data acquisition system for imaging coronery arteries.** Siskin, E.J.; Frost, M.; Morrison, J.; Ong, L.; Reiser, P.; Srinivasan, M. (NYCB Real-Time Computing, Inc., Port Washington, NY 11050). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 230-235(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The design specifications, hardware features, performance, and development costs of a FASTBUS based data acquisition system for transporting image data under the control of a VAX-11/780 computing system are described. The system currently transports digitized images from a television camera running at up to 16 bits per pixel, 512 pixels per scan line, 512 lines per frame, and 30 frames per second via FASTBUS into a large bulk memory by employing no-handshake (MS=3) block transfers at a 148 megabyte/second transfer rate.

38546 **Reconstruction of images from neuromagnetic fields.** Singh, M.; Beatty, J.; Doria, D.; Hendersen, V.W.; Huth, G.C. (Institute for Physics and Imaging Science University of Southern California 4676 Admiralty Way, Suite 932 Marina del Rey, California 90292). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 585-589(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

In response to specific stimuli, the human brain emits a measurable magnetic field from regions actively involved in processing the stimulus. We have implemented an iterative algorithm to reconstruct images from the neuromagnetic field. Computer simulation studies performed to develop the algorithm are reported. Experimental measurements of a human visually-evoked field and images reconstructed therefrom are also reported. The results demonstrate, for the first time, the feasibility of imaging multiple sources within the brain that produce a magnetic field.

38547 **Rotating X-ray collimating slit for line-scan dual-energy medical imaging.** Zeman, H.D.; Otis, J.N.; Rolfe, J.; Thompson, A.C. (Hanson Lab. of Physics, and Dept. of Physics, Stanford Univ.). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 548-552(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A rotating slit system has been designed and tested which can effectively translate a fan-shaped X-ray beam at the same average speed and in the same direction of travel as a patient moving continuously during a line-scan dual-energy medical imaging procedure. The slit has been shown to eliminate the artifacts due to bone in logarithmically subtracted images obtained with monochromatic X-ray beams derived from synchrotron radiation, where one beam is just above and the other just below the K-edge of iodine. Images of iodine-containing phantoms and in vivo canine images after intravenous iodine injection show vessel detail without artifacts due to bone. Corresponding images taken without the rotating slit have severe artifacts.

38548 **Enzyme immunoassay for swine trichinellosis using antigens purified by immunoaffinity chromatography.** Seawright, G.L.; Despommier, D.; Zimmermann, W.; Isenstein, R.S. (Los Alamos National Lab., NM). *American Journal of Tropical Medicine and Hygiene;* **32**: No. 6, 1275-1284(Nov 1983).

Various preparations of crude and a purified preparation of Trichinella spiralis antigens were compared in a rapid, microenzyme immunoassay (EIA) for detecting trichinellosis in swine. The crude antigen preparations (XM-300 or S_3 fraction) were lipid-free, cell-free fractions of muscle larvae, and the purified antigen was prepared by immunoaffinity chromatography of the soluble fraction of stichocyte secretory granules from rat muscle larvae. The antigens were tested against normal and immune swine sera for sensitivity and specificity, and for their ability to detect seroconversions early in the immune response. Tests of sequential sera from experimentally-infected pigs showed that the column antigen pro-

duced lower absorbances with pre-infection sera and, from 18 days post-infection, higher absorbances with positive sera. From 21-28 days post-infection, absorbances and S/N ratios with column antigen were nearly twice those with XM-300. Column antigen detected antibodies more often than XM-300 antigen in sera collected prior to the appearance of larvae. Crude antigen did not distinguish all true negatives from weakly positives in a study involving 100 sera from muscle digestion-negative pigs and 75 sera from experimentally infected pigs, whereas the column antigen distinguished all negatives from positives. In a larger scale test of the column antigen, 1130 pigs from Puerto Rico were tested in the micro-EIA test. Puerto Rico has no endogenous trichinellosis, and all 1130 pigs were shown to be muscle digestion negative. These results show that the column antigen out-performs the crude antigens in sensitivity, specificity, and early detection. The column antigen is therefore a major improvement in the EIA for swine trichinellosis.

38549 **Process for the production of ^{18}F-2-deoxy-2-fluoro-D-glucose.** Elmaleh, D.R.; Levy, S.; Shiue, C.Y.; Wolf, A.P. (to Dept. of Energy). US Patent Application 6-488,311. 25 Apr 1983. 12p. Contract AC02-76CH00016.

A method of preparing the radiopharmaceutical 2-deoxy-2-[^{18}F] fluoro-D-glucose (^{18}FDG) in high yield and in highly purified form is described. (ACR)

38550 **Neutron capture therapy - theory versus practice.** Bond, V.B. (Brookhaven National Lab., Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-29**: No. 1, 24-26(Feb 1982). Contract AC02-76CH00016.

The principles involved in boron neutron capture therapy are described. In this method, ^{10}B is administered in a compound expected to localize in the tumor and highly localized tumor irradiation is received from the ^{10}B(n,α)^{7}Li reaction. Depth-dose patterns in a phantom are presented and some chemical experience is also discussed.

38551 **Fecal ^{13}C analysis for the detection and quantitation of intestinal malabsorption.** Klein, P.D.; MacLean, W.C. Jr.; Watkins, J.B. (Univ. of Chicago, IL). *Journal of Laboratory and Clinical Medicine;* **97**: 439-448(Jan-Jun 1981). Contract W-31-109-ENG-38.

Use of $^{14}CO_2$ breath tests and fecal analyses for the detection and quantitation of intestinal malabsorption has been extensively documented in adult subjects. The use of radioisotopes has extended the range of breath test applications to include pediatric and geriatric subjects. Here we report a fecal ^{13}C analysis that can be used in conjunction with $^{14}CO_2$ breath tests. Twenty-four-hour fecal samples were collected before and after the administration of a labeled substrate. Simultaneous cholyglycine $^{13}CO_2$ breath tests and fecal assays were performed in five children. One child with bacterial overgrowth had an abnormal breath test and a normal fecal test. Of three children with ileal dysfunction, only one had an abnormal breath test, whereas the fecal test was abnormal in all three. Both the breath test and fecal test were abnormal for a child who had undergone an ileal resection. Both tests were normal for a child with ulcerative colitis.

38552 **Relative stabilities of ^{67}Ga complexes of lactoferrin and transferrin at various pH's.** Weiner, R.E.; Schreiber, G.J.; Hoffer, P.B.; Shannon, T. (Yale Univ. School of Medicine, New Haven, CT). *International Journal of Nuclear Medicine and Biology;* **8**: 371-378(1981). Contract AC02-78EV04625.

The ability of lactoferrin (Lf) to remove ^{67}Ga originally bound to transferrin (Tf) and Tf to dissociate ^{67}Ga originally bound to Lf was examined using the equilibrium dialysis technique. When Tf-^{67}Ga was challenged by Lf for 20 h, at pH 7.4, Lf dissociated a majority of the ^{67}Ga bound to Tf. This dissolution of the Tf-^{67}Ga complex was a specific effect due competitive uptake of ^{67}Ga by the Lf iron binding sites since neither human serum albumin nor iron-replete Lf caused any significant dissociation of ^{67}Ga bound to Tf. In contrast, under similar conditions, Tf did not remove activity from preformed Lf-^{67}Ga complex. Lowering the pH from 7.4 to 6.2 (to mimic conditions found in an abscess or tumor), had little influence on these results. The incubation pH did influence the absolute amount of the radioactivity bound to Tf and Lf. Thus, Lf present in a tumor or abscess site would be able to remove and retain the ^{67}Ga activity brought to the site by Tf whether or not acidic conditions prevailed.

5507 Microbiology

REFER ALSO TO CITATION(S) 55070037402, 37434, 37445, 38085, 38500, 38509

38553 **(DOE/ER/12086—1) Viruses of eukaryotic green algae. Progress report, August 1, 1982-July 1, 1984.** Van Etten, J.L. (Nebraska Univ., Lincoln (USA). Dept. of Plant Pathology). 1984. Contract AC02-82ER12086. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014538.

The virus, PBCV-1, which infects the eukaryotic, green alga, Chlorella-NC64A has been characterized and we have begun to look at detailed events associated with its growth cycle. In addition, we have recently discovered other dsDNA viruses from natural sources which replicate in Chlorella NC64A. These viruses can be distinguished from PBCV-1 and from each other by plaque morphology, DNA restriction patterns, and by their resistance to certain restriction endonucleases.

38554 **(N—8330032) Air pollutant production by algal cell cultures.** Fong, F.; Funkhouser, E.A. (Texas A and M Univ., College Station (USA)). Dec 1982. 3p. NTIS, PC A05/MF A01.

Euglena gracilis and Chlorella vulgaris cultures and toxic gas identification are discussed.

5508 Morphology

REFER ALSO TO CITATION(S) 55080038501

5509 Pathology

REFER ALSO TO CITATION(S) 55090038534

38555 **Computer program for the statistical analysis of disease prevalence data from survival/sacrifice experiments.** Mitchell, T.J.; Turnbull, B.W. (Union Carbide Corp., Oak Ridge, TN). *Computer Programs in Biomedicine;* **17**: 45-64(1983). Contract W-7405-ENG-26.

This paper presents a computer program for analyzing disease prevalence data from animal survival experiments in which there may also be some serial sacrifice. The method has been described in Biometrics 35 (1979) 221-234. The user is interrogated about the details of particular models he wishes to fit. Then a generalized EM algorithm is used to compute maximum likelihood estimates of various quantities of interest concerning the effects of treatment, time and presence of other diseases on the prevalences and lethalities of specific diseases of interest. Flow charts and a sample run with output are included in the appendix.

5510 Physiological Systems

38556 **Function of chemoreceptor organs in spatial orientation of the lobster, Homarus americanus: differences and overlap.** Devine, D.V.; Atema, J. (Boston Univ. Marine Program, Woods Hole, MA). *Biological Bulletin;* **163**: No. 1, 144-153(Aug 1982). Contract AC02-76EV02546.

Three of the lobster's main chemoreceptor organs, the lateral and medial antennules (representing smell) and the dactylus-propodus segments of the walking legs (representing taste), are physiologically quite similar. The authors examined their role in spatial orientation in a food-odor stimulus field. Control animals almost always oriented correctly and immediately to an odor plume. Lobsters with unilateral ablations of lateral antennules lost this ability, but did not show preferential turning toward the intact side. Unilateral medial antennule ablation did not affect orientation. Removal of all aesthetasc hairs from one lateral antennule caused loss of ori-

entation ability less severe than unilateral ablation of the entire lateral antennule. Lobsters with unilaterally ablated lateral antennules and blocked walking leg receptors turned preferentially toward the side of the intact antennule. Thus, it appears that intact lobsters orient in odor space by tropotaxis principally using aesthetasc receptor input. Since loss of appendages is relatively common in lobsters, this partial overlap of organ function may serve the animal well in nature.

38557 **Function of chemo- and mechanoreceptors in lobster (Homarus americanus) feeding behavior.** Derby, C.D.; Atema, J. (Boston Univ. Marine Program, Woods Hole, MA). *Journal of Experimental Biology;* **98**: 317-327(1982). Contract AC02-76EV02546.

The behavior of lobsters preying on live mussels (Mytilus edulis) was observed before and after chemosensory-mechanosensory deafferentation of different sensory appendages. Deafferentation of the antennules, leg tips, or maxillipeds (but not the carapace or proximal leg segments) interfered with feeding performance by causing an increase in the time necessary to crush a mussel after search initiation. In addition, deafferentation of the leg tips or the maxillipeds caused a decline in number of mussels crushed but for different reasons. Deafferentation of leg chemoreceptors resulted in the same behavioural deficiencies as deafferentation of leg chemo- and mechanoreceptors, demonstrating that it is the leg chemoreceptors that are essential in releasing this grasping response. Chemoreceptors on different appendages of lobsters therefore fulfill different functional roles in their feeding behavior.

38558 **Crustacean muscles: atrophy and regeneration during molting.** Mykles, D.L.; Skinner, D.M. (Oak Ridge National Lab., TN). pp 337-357 of Basic biology of muscles: a comparative approach. Twarog, B.M.; Levine, R.J.C.; Dewey, M.M. (eds.). New York, NY; Raven Press (1982). Contract W-7405-ENG-26.

The ultrastructure of muscle atrophy has been extensively studied in numerous vertebrate systems. By contrast, atrophy of arthropod muscle has been the subject of few investigations. All forms of atrophy share certain ultrastructural characteristics. As myofilament degradation progresses, interfibrillar space increases, there is increased organelle turnover, and the absolute amount of sarcoplasmic reticulum (SR) decreases. The Ca^{2+}-dependent proteinases (CDP) purified from the skeletal muscle of several vertebrates are believed to play an important role in myofibril protein turnover. The authors have examined the ultrastructural basis of atrophy of claw closer muscle of the land crab and the organization of myofibrils and SR during the hydrolysis of protein that occurs during proecdysis. In some ways, the ultrastructure of the accompanying claw muscle atrophy resembles that of other atrophies induced by denervation, disuse, and disease in that lysosomes do not appear to be involved in myofilament degradation. They have investigated the changes that occur in contractile proteins during claw muscle atrophy and the involvement of CDP in myofilament degradation. In contrast to other systems, there is a preferential degradation of thin filaments relative to thick filaments, resulting in an increase in thick-filament packing density.

5520 Public Health

38559 **(LA—9445-PNTX-P) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: a comparison of county and state cancer mortality rates.** Wiggs, L.D.; Wilkinson, G.S.; Tietjen, G.L.; Acquavella, J.F. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008075.

This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. This report considers cancer mortality rates in the region surrounding the Pantex nuclear weapons facility. The working hypothesis was that increased cancer mortality rates would exist in counties proximal to the Pantex Plant. To evaluate this hypothesis, we compared age-adjusted cancer mortality rates for the six surrounding counties with Texas state rates for three time periods: 150 to 1959, 1960 to 1969, and 1970 to 1978. These comparisons showed that cancer mortality rates for Carson County (where the plant is located) and the five adjacent and downwind counties were not significantly different from rates for the State of Texas.

5530 Agriculture And Food Technology

38560 **Effects on agriculture.** Bondietti, E.A. (Oak Ridge National Lab., TN (USA)). pp 121-130 of Nuclear war: the aftermath. Peterson, J.; Hinrichsen, D. (eds.). Oxford, England; Pergamon Press (1982).

Price Pound 2.95.

Radioactive contamination of croplands would be widespread in the Northern Hemisphere following a global nuclear war. Delayed fallout, in areas not directly involved in the war, would raise radioactivity levels in food and human tissues to 20 times the levels reported during the weapons' testing period of the 1960s. Agriculture would revert to a non-mechanized age and many Third World Countries, dependent on enormous imports of food from the developed countries, would be severely affected.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 56012038563

38561 **(AERE-R—11105) Comparative hazards of chemicals and radioactive waste.** Ewart, F.T. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Dec 1983. 13p. HMSO, London, price $4.00.

In considering the environmental impact of radioactive waste it is necessary to consider many issues, such as the properties and composition of the waste, the properties of the surrounding geosphere and the biosphere. This paper does not attempt to represent such a complete calculation of the eventual effects of radioactive waste disposal but uses the concept of inherent waste toxicity. In order to compare the potential hazards from radioactive waste and from other substances, commonly found in the environment, it is necessary to express both in similar units. However, the 'toxic potential' indices, which are discussed below, are merely numbers which express the total biological hazard that could arise from the complete dispersion, in air or water, of the substances concerned. This is not the same as an estimate of actual risk, which can only be arrived at by following the potential pathways to man in detail and estimating the quantities possibly ingested by a critical group.

38562 **(DOE/EV/02001—10) Neutron-induced mutation experiment. Final technical report.** Abrahamson, S. (Wisconsin Univ., Madison (USA)). Mar 1979. Contract AC02-76EV02001. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014896.

The shapes of the mutation dose-response curves for a variety of neutron energies using both sex linked lethals and specific locus mutations as endpoints for this analysis were determined in Drosophila oogonia. (ACR)

38563 **(DOE/EV/02725—T3) Repair of DNA treated with γ-irradiation and chemical carcinogens. Final report, June 1, 1981-May 31, 1984.** Goldthwait, D.A. (Case Western Reserve Univ., Cleveland, OH (USA)). 1984. Contract AC02-76EV02725. 10p. (COO—2725-07). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013286.

Work done in the past three years has been on DNA repair, on genetic transposition and on the effect of carcinogens on alu sequence transcription. DNA repair work was completed on β-propiolactone DNA adducts, on procaryotic and eucaryotic enzymes capable of removal of 3-methyladenine from DNA, and on in vitro repair of neucleosomal core particle DNA and chromatin DNA. Attempts were made to isolate a human transposable element through the isolation of double stranded RNA and probing of a human library. Experiments were also done to determine whether carcinogens altered the expression of alu sequences in human DNA.

38564 (INIS-mf—8978, pp 100) **New conception of cell kinetic models for fractionated radiation therapy (theory).** Kozubek, S. (Krajska Nemocnice s Poliklinikou, Ostrava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38565 (INIS-mf—8978, pp 101) **New conception of cell kinetic models for fractionated radiation therapy (applications).** Kozubek, S.; Willaschek, J.; Cerny, J. (Krajska Nemocnice s Poliklinikou, Ostrava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38566 (INIS-mf—8978, pp 114) **Cumulative biological effect in fractionation and the radiobiological cell characteristics.** Lokajicek, M. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav); Prokes, K. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38567 (INIS-mf—8978, pp 155) **Influence of reparation processes on cumulative biological effect at fractionated irradiation.** Prokes, K. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Lokajicek, M. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38568 (INIS-mf—8978, pp 159) **Radiosensitivity of human kidneys.** Roeder, K.; Theuring, F. (Medizinische Akademie, Magdeburg (German Democratic Republic)). 1981. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38569 (INIS-mf—8978, pp 13) **Radiation risk by mammography.** Barke, R. (Medizinische Akademie, Dresden (German Democratic Republic). Radiologische Klinik). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38570 (INIS-mf—8978, pp 122) **Oxygenation and reoxygenation of tumor cells during radiation treatment.** Pappova, N.; Siracka, E. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Vyskumny Ustav Onkologicky); Durkovsky, J. (Ustav Klinickej Onkologie, Bratislava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38571 (INIS-mf—8978, pp 163) **Relation of estrogen situation to radiation response in uterine cervical cancer.** Schreiner, P. (Komenskeho Univ., Bratislava (Czechoslovakia). Lekarska Fakulta). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38572 (INIS-mf—8978, pp 139) **Kinetics and competitive interaction of osteotropic nuclides Ce, Sr and F by their combined incorporation in the rats' bodies.** Paskalev, Z.; Kalaidgiev, G. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38573 (INIS-mf—8978, pp 140) **Determination of radiation dose rate and risk for the population around nuclear power plants.** Paskalev, Z.; Khristova, M. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38574 (INIS-mf—8978, pp 22) **Program of radiotherapy in the special project "Control of neoplastic growth" of the CNR (Italian National Research Council).** Biagini, C. (Rome Univ. (Italy). Ist. di Radiologia). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38575 (INIS-mf—8978, pp 47) **Clinical investigations on different fractionation schemes tested by histological examination of autopsy specimens from lung cancer patients.** Elichhorn, H.J. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38576 (INIS-mf—8978, pp 50) **Effect of oblique incidence in electron beam radiotherapy treatments of the entire skin.** Gamal, M.; Osman, Hasan (Roswell Park Memorial Inst., Buffalo, NY (USA)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38577 (INIS-mf—8978, pp 57) **Clinical and dosimetrical aspects of "twice-a-day" irradiation of head and neck tumours.** Gyenes, G. (Orszagos Onkologiai Intezet, Budapest (Hungary)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38578 (INIS-mf—8978, pp 75) **Preliminary report on single high-dose irradiation of upper and lower body half.** Huettner, J.; Eichhorn, H.-J. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). 1981. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38579 (INIS-mf—8978, pp 104) **Our experience in preoperative radiotherapy of the laryngeal carcinoma.** Kubovic, M.; Voskresensky, I. (Zagreb Univ. (Yugoslavia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38580 (INIS-mf—8978, pp 109) **Radiation distribution on head and neck at some lesions irradiated by betatron at 42 MeV.** Laginova, V.; Kralik, G.; Plesko, B. (Ustav Klinickej Onkologie, Bratislava (Czechoslovakia)); Kubu, V.; Nikodemova, D. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38581 (INIS-mf—8978, pp 115) **Coordinate scheme for reflecting of radioepithelites in the oral cavity.** Lyubenov, T. (Nauchno-Izsledovatelski Onkologichen Inst., Sofia (Bulgaria)). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38582 (INIS-mf—8978, pp 165) **Clinical research in optimizing radiotherapy of bronchial carcinomas by means of hyperglycemia and hyperthermia.** Schmidt, W. (Ernst-Moritz-Arndt-Universitaet, Greifswald (German Democratic Republic). Radiologische Klinik); Lippmann, H.-G. (Forschungsinstitut Manfred von Ardenne, Dresden (German Democratic Republic)); Schilling, W. (Forschungsinstitut fuer Lungenkrankheiten und Tuberkulose, Berlin-Buch (German Democratic Republic)). 1981. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38583 (INIS-mf—8978, pp 56) **Radiobiological aspects by fractionated short-time afterloading with high dose rates in intracavitary gamma-therapy of carcinoma of the uterus.** Glaser, F.H. (Martin-Luther-Universitaet Halle-Wittenberg, Halle (German Democratic Republic). Radiologische Klinik). 1981. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84780385. (CONF-8109254—Absts.).

From 5. Czechoslovak radiological congress; Bratislava, Czechoslovakia (2 Sep 1981).

38584 (INIS-mf—9005, pp 68-69) **Leuknemia morbidity in Bavaria. An epidemiological study including low-level radiation from natural and artificial sources.** Grosche, B.; Hinz, G.; Tsavachides, C. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene); Huber, O. (Salzburg Univ. (Austria)). 1983. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780512. (CONF-830995—Summ.).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

38585 (JINR—19-83-257) **Problem of enhancement of ionizing radiation biological effects. Glucose as means of increasing the radiosensitivity of Ehrlich ascite tumor cells in vitro.** Shmakova, N.L.; Fadeeva, T.A.; Lazehr, K.; Ushanova, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701525.

The effect of short-time incubation of Ehrlich ascite tumor cells in medium containing the excess of glucose on their radiosensitivity over the development of ascites and solid tumors was studied. The study has revealed that incubation of cells with glucose is accompanied by the change in pH suspension and induced only a low increase in latent period of development of solid tumors and in surviving time of mices with ascite tumors. However, it increases sufficiently the lethal effect of irradiation over these criteria, as well as over the percent of tumor transplantability.

38586 (KAERI/RR—352/82, pp 1-88) **Utilization of irradiation on food preservation.** Cho, H.O.; Kwon, J.H.; Byun, M.W.; Yang, H.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780329.

In Utilization of irradiation on food preservation and agriculture production increase.

The research programme in 1982 was conducted not only to develop the commercial storage method of sprouting foods by irradiation combined with natural low temperature and to sterilize the E.coli of ginseng and ginseng product but also to approach the development of the long term storage method of rice and barley.

38587 (KAERI/RR—352/82, pp 1-88) **Utilization of irradiation on agricultural production increase.** Chung, K.H.; Oh, C.H.; Lee, Y.I.; Song, H.S.; Choi, Y.H.; Shin, I.C.; Kang, S.C. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780329.

In Utilization of irradiation on food preservation and agricultural production increase.

This study was conducted to develop desirable lines of the legume crops by improving the defective traits of the existing varieties by means of induced mutation and to assess the selected promising lines for nominating them as new varieties under a joint research project with the Office of Rural Development. Some fundamental experiments were also carried out to resolve problems concerned with mutation breeding.

38588 (KAERI/RR—352/82) **Utilization of irradiation on food preservation and agriculture production increase.** (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 192p. (In Korean). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780329.

Separate abstracts have been prepared for individual papers for inclusion in the Energy Data base.

38589 (KAERI/RR—386/82, pp 1-116) **Environmental impact assessment of thermal discharges and radioactive effluents from nuclear power plants.** Lee, J.H.; Kim, Y.W.; Kim, K.C.; Cho, T.J.; Yoo, B.S.; Park, H.K.; Yoo, K.I. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780328.

In Environmental impact studies around nuclear facilities.

The effects of both radioactive and thermal effluents discharged from the plant on aquatic ecosystem is one of the primary concerns in evaluating the environmental impact due to the operation of the nuclear power plant. This report deals with ecological studies of marine organisms and the impact assessment of radioactive and thermal effluents from Kori nuclear power plant unit 1.

38590 (KAERI/RR—386/82, pp 257-329) **Study on the diffusion model of radioactive effluents.** Lee, Y.B.; Kim, B.U. 1983. (In Korean). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84780328.

In Environmental impact studies around nuclear facilities.

Maximum individual doses at the boundary, population doses and individual doses in the major 10-cities within 80km radius from the site by gaseous radioactive effluents during normal operation of nuclear power station-Kori unit No.1, have been calculated for the years of '80, '81 and '82. For the year of 1980 owing to the discharge of radioactive particulates, maximum individual doses of adult was 20, 17 and 18 mrem/yr for each exposed organ-total body, thyroid and skin which were far below the ICRP recommendation but showed an excess over US 10 CFR 50 Appendix I design objectives. And for 1982 owing to the discharge of a reasonable quantity of noble gases, annual beta and gamma dose rates were 0.16 and 0,05 mrad/yr which were increased more than any other years, but negligible. And population doses and individual doses for 10-cities were far below the criteria. Besides, a great population growth was caused by the expansion of industrial complexes within 80km radius of the site.

38591 **(LA—9445-PNTX-E) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: review of occupational exposures to radiation.** Elder, J.C. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008064.

This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's (DOE) Pantex Plant near Amarillo, Texas. Radiation dosimetry records over the recent past were reviewed to provide an assessment of the occupational exposure control program. The results of that review are discussed in terms of dose measurement practices, sources of dose, and experience regarding dose accumulated by members of the work force over the period 1966 to 1981. Whole body doses to a group of workers receiving a defined above-average cumulative dose are discussed in terms of job assignments and sources of exposures. Results of a review of radiation incident reports are discussed. Ongoing efforts to reduce occupational doses are described.

38592 **(LA—9445-PNTX-F) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: radiological consequences of immediate inhalation of plutonium dispersed by postulated accidents.** Elder, J.C.; Olsher, R.H.; Graf, J.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 67p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84008065.

This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's (DOE) Pantex Plant near Amarillo, Texas. It describes methods used to estimate potential health consequences offsite resulting from inhalation of plutonium dispersed by each of several postulated accidents. The primary topic of this report is the delayed health effects of the plutonium in a nonnuclear detonation debris inhaled directly by members of the population in the cloud path. The expected form and size of the plutonium particles are derived from experimental data obatined in the Roller Coaster test series of 1963. Retention characteristics based on the International Commission on Radiation Protection (ICRP) Task Group Lung Model and organ dose calculations based on a modified computer model are described. Health risk estimates based on organ dose are made using appropriate risk factors recommended by international radiation protection organizations. The relative seriousness of each accident at each alternative site is assessed on the basis of the health risk estiamtes.

38593 **(LA—9445-PNTX-O) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: long-term radiological risk assessment for postulated accidents.** Wenzel, W.J.; Gallegos, A.F. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 80p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84008074.

This report documents work performed in support of preparation of an Environmental Impact Statement regarding the Department of Energy's (DOE) Pantex Plant near Amarillo, Texas. The long-term health effects to people farming the areas studied by Wenzel in 1982 are calculated in this report by predicting plutonium transport in the Texas Panhandle, southeastern Iowa, and south central Washington using the BIOTRAN model. Inhalation and ingestion radiation doses are calculated for each hypothetical accident with releases of 120-, 30-, and 0.625-kg plutonium at the Pantex Plant and the Iowa Army Ammunition Plant (IAAP). The greatest radiation dose for the Pantex Plant and IAAP accidents is the inhalation dose, which accounts for greater than 90% of the long-term effect. Only a 0.625-kg plutonium release is addressed for the Hanford site. Deposited PuO_2 at levels greater than 0.4 $\mu Ci/m^2$ dose not extend offsite. Therefore, health effects were not calculated for Hanford. The estimated number of health effects (cancer deaths) based on 1990 populations was higher for these accidents at the Pantex Plant than the IAAP; but the cancer mortality risk (chance/100,000) was found to be greater at the IAAP because of the larger population density closer to the IAAP.

38594 **(LA—9445-PNTX-Q) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: occupational work force mortality study.** Acquavella, J.F.; Wiggs, L.D.; Waxweiler, R.J.; Macdonell, D.G.; Wilkinson, G.S. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008076.

This report documents work performed in support of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. We compared total and cause-specific mortality for Pantex Plant workers employed between 1951 and December 31, 1978, with expected mortalities based on US death rates. We observed significantly fewer deaths than expected from all causes of death: all cancers (digestive cancers and lung cancer), arteriosclerotic heart disease, and digestive diseases. No causes of death occurred significantly more frequently than expected. Analyses of worker mortality by duration of employment, time since first employment, and radiation exposure greater than 1.00 rem produced similar results. We found no evidence that mortality from any cause of death was increased as a result of employment at the Pantex Plant.

38595 **(LA—9994-MS) HUMTRN: documentation and verification for an ICRP-based age- and sex-specific human simulation model for radionuclide dose assessment.** Gallegos, A.F.; Wenzel, W.J. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 87p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84015055.

The dynamic human simulation model HUMTRN is designed specifically as a major module of BIOTRAN to integrate climatic, hydrologic, atmospheric, food crop, and herbivore simulation with human dietary and physiological characteristics, and metabolism and radionuclides to predict radiation doses to selected organs of both sexes in different age groups. The model is based on age- and weight-specific equations developed for predicting human radionuclide transport from metabolic and physical characteristics. These characteristics are modeled from studies documented by the International Commission on Radiological Protection (ICRP 23). HUMTRN allows cumulative doses from uranium or plutonium radionuclides to be predicted by modeling age-specific anatomical, physiological, and metabolic properties of individuals between 1 and 70 years of age and can track radiation exposure and radionuclide metabolism for any age group for specified daily or yearly time periods. The simulated daily dose integration of eight or more simultaneous air, water, and food intakes gives a new, comprehensive, dynamic picture of radionuclide intake, uptake, and hazard analysis for complex scenarios. A detailed example using site-specific data based on the Pantex studies is included for verification. 14 references, 24 figures, 10 tables.

38596 **(NUREG/CR—3346) Bioassay data and a retention-excretion model for systemic plutonium.** Leggett, R.W. (Oak Ridge National Lab., TN (USA)). May 1984. Contract AC05-84OR21400. 96p. (ORNL/TM—8795). NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84013065.

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The estimation of systemic burdens from urinalyses has been the most common and useful method of quantifying occupational exposures to plutonium. Problems arise in using this technique, however, because of inadequate modeling of human retention, translocation, and excretion of this element. Present methods for estimating the systemic burden from urinalyses were derived to a large extent from patterns observed in the first few months after exposure, but there is now evidence that these same patterns do not persist over long periods. In this report we collect and discuss data needed for the interpretation of bioassay results for Pu. These data are used to develop a model that describes the movement, retention, and excretion of systemic Pu in the human body in terms of explicitly identified anatomical compartments. This model may be used in conjunction with existing models and/or case-specific information concerning the translocation of Pu from the respiratory or gastrointestinal tract or from wounds to the bloodstream. Attention is restricted to the behavior of Pu after it has gained access to the bloodstream. There remain significant uncertainties concerning some aspects of the movement of Pu, particularly its translocation

from the liver. An attempt has been made to construct the model in such a way as to elucidate those areas needing further attention. 98 references, 18 figures, 16 tables.

38597 **(PB—84-167840) Calculation programs for routine compliance testing of diagnostic x-ray systems.** (National Center for Devices and Radiological Health, Rockville, MD (USA)). Dec 1983. 84p. NTIS, PC A05/MF A01.

Supersedes PB81-200503.

The Federal diagnostic x-ray equipment standard is aimed at reducing patient exposure during x-ray examinations. Its significance lies in the fact that 90 percent of the U.S. population's exposure from manmade sources is attributed to the diagnostic use of x-ray. More than 130 million people in this country are estimated to receive some kind of x-ray examination each year. In essence, this standard calls for equipment capable of providing more reliable diagnostic information with an increased level of radiation protection. Components covered by the standard are tube-housing assemblies, x-ray controls, x-ray high-voltage generators; fluoroscopic imaging assemblies, tables, cradles, film changers, cassette holders, and beam-limiting devices.

38598 **(PNL—5000-Pt.1) Pacific Northwest Laboratory annual report for 1983 to the DOE Office of Energy Research. Part 1. Biomedical sciences.** Park, J.F. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 138p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84007437.

This report summarizes progress on Office of Health and Environmental Research (OHER) biomedical and health effects research conducted at PNL in FY 1983 to develop the information required for a comprehensive understanding of the interaction of energy-related pollutants with living organisms. The first section is devoted to an evaluation of possible health effects among nuclear workers. The next three sections, which contain reports of health effects research in biological systems, are grouped according to the major endpoint being studied: carcinogenesis, mutagenesis, and systems damage. Since some projects have multiple objectives, a section may contain data concerning other endpoints as well. The section on carcinogenesis presents results from laboratory animal dose-effect relationship studies from both nuclear and synfuels materials. These data, along with metabolism and modeling studies, provide a basis for predicting human risks in the absence of relevant human exposure. This year we include a report on our 22nd Hanford Life Sciences Symposium, which dealt with this problem of extrapolating the results of animal studies to man. Of particular importance in carcinogenesis has been the demonstration that the carcinogenic potencies of complex organic synfuel mixtures may be much lower (or, occasionally, higher) than the sum of the potencies of the individual components. The mutagenesis section is primarily concerned with the results of microbial mutagenesis studies with synfuel materials. These studies provide valuable information on the carcinogenic potential of these complex organic mixtures. With results from studies reported in the carcinogenesis section, they are also being used to establish an adequate data base for determining the correlation between mutagenic and carcinogenic processes. Separate abstracts have been prepared for each program for inclusion in the Energy Data Base.

38599 **Magnetic resonance and ionizing radiation: a comparative evaluation in vitro of oncogenic and genotoxic potential.** Geard, C.R.; Osmak, R.S.; Hall, E.J.; Simon, H.E.; Maudsley, A.A.; Hilal, S.K. (Columbia Univ., New York, NY). *Radiology;* **152**: No. 1, 199-202(Jul 1984). Contract AC02-83ER60142.

This paper describes experiments designed to investigate possible biological hazards associated with magnetic resonance (MR) imaging. Mouse C3H 10T1/2 cells were exposed to a powerful magnetic field for periods up to 17 hours together with pulsed field gradients and radio-frequency excitation and compared with untreated controls and cells exposed to gamma rays. In the case of oncogenic transformation, no significant difference could be demonstrated between controls and either the gamma-irradiated or MR-exposed cells. When mitotic cells were examined for chromosomal alterations, the frequencies of both chromosomal aberrations per cell and sister chromatid exchanges per chromosome were significantly enhanced over control levels after ionizing radiation exposures but were similar to control (or less) after MR exposures. These studies confirm the known deleterious effects of ionizing radiation (even at low doses) for chromosomal damage, if not for oncogenic transformation, yet show that MR exposures even of long duration at high field strengths do not result in effects greater than 0.3 Gy of gamma rays.

38600 **Analysis of chromosomally aberrant cells based on beta-binomial distribution.** Otake, M.; Prentice, R.L. (Univ. of Washington, Seattle). *Radiation Research;* **98**: No. 3, 456-470(Jun 1984). Contract AC01-76EV03161.

Analysis carried out here generalized on earlier studies of chromosomal aberrations in the populations of Hiroshima and Nagasaki, by allowing extrabinomial variation in aberrant cell counts corresponding to within-subject correlations in cell aberrations. Strong within-subject correlations were detected with corresponding standard errors for the average number of aberrant cells that were often substantially larger than was previously assumed. The extrabinomial variation is accommodated in the analysis in the present report, as described in the section on dose-response models, by using a beta-binomial (β-B) variance structure. It is emphasized that we have generally satisfactory agreement between the observed and the β-B fitted frequencies by city-dose category. The chromosomal aberration data considered here are not extensive enough to allow a precise discrimination between competing dose-response models.

38601 **Some effect of random dose measurement errors on analyses of atomic bomb survivor data.** Gilbert, E.S. (Pacific Northwest Lab., Richland, WA). *Radiation Research;* **98**: No. 3, 591-605(Jun 1984).

The effects of random dose measurement errors on analyses of atomic bomb survivor data are described and quantified for several analytical procedures. It is found that the ways in which measurement error is most likely to mislead are through downward bias in the estimated regression coefficients and through distortion of the shape of the dose-response curve. The magnitude of the bias and the power for testing the hypothesis of no effect are evaluated for several dose treatments including the use of grouped and ungrouped data, analyses with and without substituting 600 rad for estimated doses exceeding this value, and analyses which exclude doses exceeding 200 rad. The calculations are based on a model in which the error distributions are assumed to be log normal with standard deviations that are 0, 30, and 50%, respectively, of the true dose values. Results are limited to a dose-response function which is linear on total dose.

38602 **^{228}Th retention and dosimetry in beagles.** Lloyd, R.D.; Jones, C.W.; Mays, C.W.; Atherton, D.R.; Bruenger, F.W.; Taylor, G.N. (Univ. of Utah, Salt Lake City). *Radiation Research;* **98**: No. 3, 614-628(Jun 1984). Contract AC02-76EV00119.

Total-body and skeletal retention of ^{228}Th were determined in a group of 104 young adult male and female beagles for about the first 7 years after the injection of 0.00159 to 2.76 μCi/kg. Ratios of ^{224}Ra/^{228}Th, ^{212}Pb/^{228}Th, and ^{212}Bi/^{228}Th in the skeleton and in soft tissues of 20 beagles were measured as a function of time after injection. A humerus, femur, and ulna from 20 dogs dying 7 to 554 days after injection were sectioned, and the ^{228}Th concentration was obtained for each piece. Ratios of daughter-to-parent activity in soft tissue showed no definite trend with dose level or time and averaged Ra/Th = 0.56, Pb/Th = 0.83, and Bi/Th = 0.91, whereas the ratios for the skeleton varied with both dose level and time. Retained ^{228}Th was deposited most heavily in parts of the skeleton with much trabecular bone, much bone surface area, and high bone remodeling rates. No changes in this deposition pattern could be discerned during the 554 days over which the measurements of sectioned long bones were made.

38603 **Iodine-129 in waterfowl muscle from a radioactive leaching pond complex in southeastern Idaho.** Halford, D.K.; Markham, O.D. (Dept. of Energy, Idaho Falls, ID). *Health Physics;* **46**: No. 6, 1259-1263(Jun 1984).

Waterfowl were collected at radioactive leaching ponds, an adjacent sewage lagoon on the Idaho National Engineering Laboratory (INEL) and on nearby control areas to determine $^{129}I/^{127}I$ (stable isotope) atom ratios in muscle tissue. Iodine-129/127 atom ratios in muscle tissue averaged about 1.6×10^{-6} for wild waterfowl from the leaching pond, 1.6×10^{-6} for waterfowl from the sewage pond, and 1.3×10^{-6} for control samples. A group of wing-clipped waterfowl placed on the ponds for 2-156 days had average $^{129}I/^{127}I$ atom ratios in muscles of 6.0×10^{-6}. Internal lifetime whole-body dose from ^{129}I was estimated to be 1.0×10^{-5} mrad for waterfowl from control areas and 3.0×10^{-5} mrad for leaching pond waterfowl. Liquid effluents disposed in the radioactive leaching ponds do not appear to cause an appreciable increase in $^{129}I/^{127}I$ atom ratios in tissues of waterfowl using the ponds.

38604 **Contributions of a nuclear fuel chemical separations facility to the plutonium content of a tobacco crop.** McLeod, K.W.; Pinder, J.E. Jr.; Watts, J.R. (Savannah River Ecology Lab., Aiken, SC). *Health Physics;* **46**: No. 6, 1205-1211(Jun 1984). Contract AC09-76SR00819.

Tobacco, an important crop in the southeastern United States, can potentially contribute via the inhalation pathway to the dose-to-man from radionuclides. To evaluate this potential dose-to-man from the interception and retention of Pu aerosols, a tobacco crop was grown near a chemical separations facility at the Savannah River Plant (SRP) which releases Pu to the atmosphere. Average leaf ^{238} Pu and /sup 239,240/Pu concentrations were 9.8 and 5.1 fCi/g x dry wt, respectively. These concentrations indicate that 2.5% of the deposition occurring during the tobacco growth period was on merchantable leaves. Leaf Pu concentrations were slightly greater than Pu concentration of stem tissue. Tobacco grown near the facility had 10 times higher Pu concentrations than that grown off the SRP.

38605 **Comparison of the carcinogenicity of radium and bone-seeking actinides.** Raabe, O.G. (Univ. of California, Davis). *Health Physics;* **46**: No. 6, 1241-1258(Jun 1984). Contract AC03-76SF00472.

The relative effectiveness of nine bone-seeking radionuclides with their progeny for the production of malignant skeletal tumors (mostly osteogenic sarcoma), principally by chronic alpha-particle irradiation, is examined with available data obtained from lifetime studies at three laboratories of pure-bred beagles exposed to graded dosages in controlled experiments. The lifetime tumor dose-rate/time-response relationships observed in beagles injected with ^{226}Ra at the University of California at Davis, in which 123 cases of bone cancer (98% osteosarcoma) have been observed for dose rates between 0.05 and 20 rad/day, provide the basis for comparing the induction of bone cancer by the other radionuclides. All nine radionuclide studies were found to demonstrate with high precision a three-dimensional lognormal response relationship represented in two dimensions by the equation of the time to death from bone cancer. The results show the relative biological effectiveness (RBE) for bone-cancer induction potency with respect to radiation exposure from ^{226}Ra to be 3.0 for ^{225}Ra, 6.4 for ^{241}Am, 6.6 for ^{249}Cf, ^{252}Cf and ^{253}Es, 9.0 for ^{239}Pu, 10.7 for ^{228}Th, and 15.5 for ^{238}Pu.

38606 **Assessment of health risk from radiation exposures.** Dunning, D.E. Jr.; Leggett, R.W.; Sullivan, R.E. (Oak Ridge National Lab., TN). *Health Physics;* **46**: No. 5, 1035-1051(May 1984).

A methodology has been developed to assess potential hazards from low-level exposures to radioactive pollutants. Estimates of dose rates to reference organs from internal and external exposure pathways (inhalation of contaminated air, ingestion of contaminated food or water, immersion in contaminated air, and exposure to contaminated ground surfaces) are computed with contemporary dosimetric models. These dose rates are used in a life-table analysis to estimate the radiation-induced cancer deaths and resultant years of life lost in an exposed cohort of 100,000 persons, all simultaneously liveborn and subject to the same risks of dying from competing causes (including natural background radiation). Estimates of the potential health risk are tabulated for approx. 150 radionuclides for each of the exposure pathways; results are summarized in terms of the probability of premature radiation-induced death for a member of the cohort due to incremental radiation exposure, and the average number of years of life lost per incremental fatality.

38607 **Computer based plutonium wound monitor.** Waechter, D.A.; Brake, R.J.; Erkkila, B.H.; Vasilik, D.G. (Los Alamos Nat'l. Lab., Los Alamos, NM 87547). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 679-681(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A new plutonium wound monitor has been developed at Los Alamos to upgrade a system which has been in use for about five years. The instrument, called a Computerized Wound Screening System, is designed around a readily available personal computer. It includes a full-function 256-channel pulse height analyzer and software necessary to calculate plutonium and americium activity from a spectrum. This new system provides medical and health physics personnel with considerable flexibility in recognizing and recording situations where a wound incurred in a plutonium processing facility might be contaminated. This flexibility includes fast, accurate determination of contaminants in a wound, hard copy printout of results, and full patient logging capabilities via flexible disk storage. Use of a low cost computer greatly simplifies hardware and software design, and makes duplication of the instrument very simple and inexpensive.

38608 **Stem-spermatogonial survival and incidence of reciprocal translocations in the γ-irradiated boar.** Erickson, B.H.; Martin, P.G. (Oak Ridge Associated Universities, TN). *Environmental Mutagenesis;* **6**: No. 2, 219-227(1984). Contract AC05-76OR00033.

To assess the effects of γ-radiation on stem-cell survival and incidence of reciprocal translocations, boar testes were irradiated with 100, 200, or 400 rad. Stem-cell survival was markedly affected by 100 rad (51% of control) and reduced to 34% of control by 400 rad. Production of differentiating spermatogonia was all but completely interrupted by 200 rad and spermatogonial renewal was incomplete at 12 weeks. From the state of the seminiferous epithelium at 12 weeks, estimates of the percentage of permanent impairment of sperm-producing capacity ranged from 20 +/- 6 (100 rad) to 67 +/- 10 (400 rad). Incidence of translocations peaked at 200 rad and the number occurring at 100 and 400 rad was similar. Kinetics of porcine spermatogonial renewal differs considerably from those of the rodent and, relative to the rodent, this may account for the boar's higher sensitivity to stem-cell killing and lower sensitivity to translocations.

38609 **Kinetics of UV-induced changes in deoxynucleoside triphosphate pools in Chinese hamster ovary cells and their effect on measurements of DNA synthesis.** Newman, C.N.; Miller, J.H. (Pacific Northwest Lab., Richland, WA). *Biochemical and Biophysical Research Communications;* **116**: No. 3, 1064-1069(15 Nov 1983). Contract AC06-76RL01830.

Measurements of dNTP pools following exposure of Chinese hamster ovary cells to ultraviolet radiation reveals a rapid accumulation of cellular dTTP and a rapid loss of cellular dCTP. Exposure to 3-, 10- or 20 Jm^{-2} results in a 3-, 4- or 5.4-fold increase in cellular dTTP, respectively, within the first 10 min after exposure. dTTP levels then decrease noticeably approaching the control value 3 to 5 hr later. In contrast, dCTP levels decrease rapidly within 10 min after exposure, ultimately to 1/10 that observed in the unirradiated control population. Recovery to normal dCTP levels is slow, taking in excess of 12 hr. No change in dATP is observed for 1-2 hr; subsequently, a moderate decrease in dATP levels occurs which is then followed by recovery, beginning 8 hr after irradiation. These results contrast with changes in dNTP pools observed in Chinese hamster V-79 cells exposed to mutagens. Measurements of rates of DNA synthesis by pulse-labelling cells with [^{3}H] thymidine are also apparently affected by UV-induced transient deviations in the endogenous radiospecific activity of the labeled precursor.

38610 **Estimating the carcinogenetic effects on humans of low doses of radiation or chemicals.** Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Journal of Environmental Science and Health, Part A: Environmental Science and Engineering;* **A17**: No. 4, 599-603(1982).

The author's knowledge of DNA repair is briefly summarized. It is proposed that a knowledge of the concentration of DNA adducts as a function of dose is essential for the extrapolation of carcinogenic dose-response data to low doses.

38611 **Oncogenic transformation produced by agents and modalities used in cancer therapy and its modulation.** Borek, C.; Hall, E.J. (Columbia Univ., New York, NY). *Annals of the New York Academy of Sciences;* 193-210(1982).

The long-term survival of certain patients after treatment with radiation or chemotherapeutic agents has allowed the realization that agents that effectively control cancer in the human subject may also possess an oncogenic potential, resulting in secondary malignancies in a significant proportion of surviving patients. A quantitative assessment of the oncogenic effects of these agents at a cellular level is important, as is information on conditions and agents that may effectively alter the development of the neoplastic state. Cell culture systems where the neoplastic transformation of cells can be scored after exposure to carcinogens offer powerful tools for evaluating the oncogenic potential of radiation and chemotherapeutic agents.

38612 **Repair responses to DNA damage: enzymatic pathways in E coli and human cells.** Hanawalt, P.C.; Cooper, P.K.; Ganesan, A.K.; Lloyd, R.S.; Smith, C.A.; Zolan, M.E. (Stanford Univ., CA). *Journal of Cellular Biochemistry;* **18**: 271-283(1982).

Bacteria and eukaryotic cells employ a variety of enzymatic pathways to remove damage from DNA or to lessen its impact upon cellular functions. Most of these processes were discovered in Escherichia coli and have been most extensively analyzed in this organism because suitable mutants have been isolated and characterized. Analogous pathways have been inferred to exist in mammalian cells from the presence of enzyme activities similar to those known to be involved in repair in bacteria, from the analysis of events in cells treated with DNA damaging agents, and from the analysis of the few naturally occurring mutant cell types. Mammalian cells possess an excision repair pathway similar to the constitutive pathway in E coli. Although not as well understood, the incision event is at least as complex, and repair resynthesis produces patches of about the same size as the constitutive short patches. In mammalian cells, no patches comparable in size to those produced by the inducible pathway of E coli are observed. Endonuclease V of bacteriophage T4 incises DNA at pyrimidine dimers by cleaving first the glycosylic bond between deoxyribose and the 5'pyrimidine of the dimer and then the phosphodiester bond between the two pyrimidines. We have cloned the gene (den V) that codes for this enzyme and have demonstrated its expression in uvrA recA and uvrB recA cells of E coli. Because T4 endonuclease V can alleviate the excission repair deficiency of xeroderma pigmentosum when added to permeabilized cells or to isolated nuclei after UV irradiation, the cloned denV gene may ultimately be of value for analyzing DNA repair pathways in cultured human cells.

38613 **Characterization of long patch excision repair of DNA in ultraviolet-irradiated Escherichia coli: an inducible function under rec-lex control.** Cooper, P.K. (Stanford Univ., CA). *Molecular and General Genetics;* **185**: 189-197(1982). Contract AT03-76EV70007.

Excision repair in ultraviolet-irradiated wild-type Escherichia coli produces a bimodal distribution of repair patch sizes in the DNA. Approximately 99% of the repair events result in short patches of 20-30 nucleotides produced by a constitutive repair system. The remaining 1% result in patches which are at least 1,500 nucleotides in length. This long patch repair is shown to be a damage-inducible process under control of the rec-lex regulatory circuit. The kinetics of the two processes differ; short patch synthesis begins immediately after irradiation and is virtually completed prior to synthesis of the majority of the long patches. Long patch repair synthesis is a linear function of UV dose up to a plateau at 60 J/m^2, and hence each long patch event is the consequence of a single UV-induced lesion. Long patch repair does not appear to be necessarily error-prone, since no alteration in repair synthesis occurs as a result of a mutation umuC$^-$ which renders cells nunmutable by UV. Evidence is presented suggesting that DNA polymerase I is responsible for both long and short patch synthesis in wild type cells under inducing conditions. In the absence of polymerase I the constitutive patch size averages 80-90 nucleotides, and this distribution is unchanged by induction.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 56020038589

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 56030037169, 37188, 37516, 37518, 38385, 38395, 38403, 38455, 38563, 38598

38614 **(CONF-840604—15) Enhancement of lung tumor formation in mice.** Witschi, H.P. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014276.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

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There is now a great deal of data available to show that butylated hydroxytoluene (BHT) enhances the development of lung tumors in mice. In many ways BHT functions like a promoting agent. Interestingly, it also has tumor enhancing or promoting properties in organs other than mouse lung such as rat liver, rat bladder, possibly rat GI tract and in in vitro systems. The development of lung tumors by BHT may be influenced by comparatively low exposure regimens; the minimum dose found so far to be effective are 6 intraperitoneal injections of 50 mg/kg or a diet containing 500 ppM of BHT for 2 weeks. While these findings seem to require that the continued use of BHT as a food additive needs to be reevaluated it should be mentioned that other considerations have lead to the conclusion that BHT probably has a large margin of safety. This makes it important to establish the mechanism of action of BHT which remains unknown. 41 references, 1 figure, 3 tables.

38615 **(DOE/EV/03140—8) Toxicology and metabolism of nickel compounds. Progress report, December 1, 1983-November 30, 1984.** Sunderman, F.W. Jr. (Connecticut Univ., Farmington (USA). School of Medicine). 15 Jul 1984. Contract AC02-76EV03140. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014919.

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The toxicology of nickel compounds (e.g., $NiCl_2$, Ni_3S_2, $Ni(CO)_4$) was investigated in rats. The following new knowledge was acquired: (1) renal cytosol from $^{63}NiCl_2$-treated rats contains at least ten ^{63}Ni-binding proteins and polypeptides with molecular weights ranging from 168,000 to <4,000 daltons; (2) parenteral administration of $NiCl_2$ to rats transiently diminishes hepatic concentrations of reduced and oxidized glutathione and enhances lipid peroxidation; (3) tetraethylenepentamine is equally effective as diethyldithiocarbamate as an antidote for acute $Ni(CO)_4$ poisoning in rats; (4) Ni[II]-induction of heme oxygenase activity in rat kidney is sustained for only 3 days of repeated treatments and thereafter gradually decreases, indicating adaptive tolerance for Ni[II] toxicity; (5) carcinogenesis bioassays of 17 nickel compounds by ir administration to rats demonstrate close correlation between the induction of erythrocytosis at 1 to 4 months post-injection and the subsequent incidence of renal cancers; (6) immunoreactive erythropoietin concentration is increased in kidney extracts of rats following ir injection of Ni_3S_2, supporting the role of erythropoietin in Ni_3S_2-induced erythrocytosis; (7) arteriosclerotic lesions in Ni_3S_2-treated rats can be visualized by focal fluorescence of hematoporphyrin derivative injected iv 24 hours prior to necropsy; and (8) marked hypernickelemia is a consistent finding in patients with endstage renal disease receiving chronic hemodialysis treatment. 13 references.

38616 **(DOE/EV/10328—T2) Molecular biology of environmental aromatic hydrocarbons. Progress report, September 1983-July 1984.** Weiss, S.B. (Chicago Univ., IL (USA)). Aug 1984. Contract AC02-80EV10328. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015235.

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Progress is reported in the following areas: (1) the reaction of polycyclic aromatic hydrocarbons (PAH) epoxide derivatives with single- and double-stranded DNAs; and (2) use of short DNA oligomers for studying (+)trans-BP-7,8-dihydrodiol-9,10-epoxide (BPDE) induced mutagenesis. (ACR)

38617 **(FWS/OBS—80/40.16) Comparative analyses of fish populations in naturally acidic and circumneutral lakes in northern Wisconsin.** Wiener, J.G. (Fish and Wildlife Service, Kearneysville, WV (USA). Eastern Energy and Land Use Team). Sep 1983. 119p. NTIS, PC A06/MF A01. Order Number DE84901178.

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Fish populations in six naturally acidic (autumnal pH 5.1 to 6.0) and six circumneutral (autumnal pH 6.7 to 7.5) clear-water lakes in north central Wisconsin were studied, and characteristics of fish populations and communities in the lakes were compared. The two groups of lakes were morphologically similar and of the same hydrologic types, but differed substantially in pH, alkalinity, waterborne calcium, and related chemical characteristics. Fish communities in the acidic lakes contained fewer species, and common as well as rare species occurred with lower frequency in the acidic lakes than in the circumneutral lakes. Certain taxa, such as minnows and darters were well represented in the circumneutral lakes, but were absent or scarce in the acidic lakes. Growth, condition, and serum calcium concentrations of bluegills were negatively correlated with population density and were not related to either pH or waterborne calcium concentrations in these lakes. Results of serum calcium analyses suggested that white suckers were stressed in lakes with autumnal pH equal to or less than 5.6 and water borne calcium equal to or less than 2.0 mg/l. Mean concentrations of Cd and Pb in whole, 4-year-old bluegills were inversely correlated with both pH and waterborne calcium concentration. Mercury levels in axial muscle tissue of walleyes from two acidic lakes were substantially higher than in walleyes of the same age from three circumneutral lakes and exceeded the 1.0 ug/g USFDA Action Level in about 35% of the fish analyzed. 168 references, 6 figures, 21 tables.

38618 **(K/D—5573-Rev.1) Report on toxicological studies concerning exposures to UF_6 and UF_6 hydrolysis products.** Just, R.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jul 1984. Contract AC05-84OT21400. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015354.

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This report presents estimates of the toxicity of uranium and hydrogen fluoride. Recommendations for the use of this information in safety analysis reports are given. 6 references, 2 figures, 4 tables. (ACR)

38619 **(N—8330023) Candidate species selection and controlled environment injuries.** Tibbitts, T.W. (Wisconsin Univ., Madison (USA)). Dec 1982. 1p. NTIS, PC A05/MF A01.

In NASA. Ames Research Center. Controlled Ecol. Life Support System p 23 (See N83-30016 18-54).

Research was undertaken to attempt to identify the causal agents for intumescences that develop on many different species of plants in controlled environments. Concentration and filtration procedures were not successful in identifying any particular compounds. The injury was found to develop, even though the atmosphere for the plants is filtered through activated charcoal, potassium permanganate, or is subjected to catalytic combustion at 450 C. Thus, the causal agent is apparently either an oxidized compound or specific element, or the result of some unrecognized variation in physical conditions around the plants. The research has demonstrated that the injury is controlled to a significant extent by temperature. Growing temperatures of 20 degrees and 25 degrees C resulted in serious injury on plants, but temperatures of 30 C resulted in very little injury.

38620 **(N—8330026) Plant growth in controlled environments in response to characteristics of nutrient solutions.** Raper, C.D., Jr. (North Carolina State Univ., Raleigh (USA)). Dec 1982. 4p. NTIS, PC A05/MF A01.

In NASA. Ames Research Center. Controlled Ecol. Life Support System p 29-32 (See N83-30016 18-54).

Emphasis was given to environmental factors that alter the flux of carbohydrate from the shoot to the root system to support the absorption of nitrogen and the subsequent interaction between nitrogen uptake and whole plant growth. Only the nitrate form of nitrogen was utilized in order to establish base line responses for evaluation of future studies utilizing both ammonium and nitrate.

38621 **(PNL—5135) Behavior of complex mixtures in aquatic environments: a synthesis of PNL ecological research.** Fickeisen, D.H.; Vaughan, B.E. (eds.). (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015053.

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The term complex mixture has been recently applied to energy-related process streams, products and wastes that typically contain hundreds or thousands of individual organic compounds, like petroleum or synthetic fuel oils; but it is more generally applicable. A six-year program of ecological research has focused on four areas important to understanding the environmental behavior of complex mixtures: physicochemical variables, individual organism responses, ecosystems-level determinations, and metabolism. Of these areas, physicochemical variables and organism responses were intensively studied; system-level determinations and metabolism represent more recent directions. Chemical characterization was integrated throughout all areas of the program, and state-of-the-art methods were applied. 155 references, 35 figures, 4 tables.

38622 **(UCRL—90841) Prospects for cellular mutational assays in human populations.** Mendelsohn, M.L. (Lawrence Livermore National Lab., CA (USA)). 29 Jun 1984. Contract W-7405-ENG-48. 11p. (CONF-8405207—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014706.

From Symposium on assessment of risk from low level exposure to radiation and chemicals; Upton, NY, USA (20 May 1984).

Practical, sensitive, and effective human cellular assays for detecting somatic and germinal mutations would have great value in environmental mutagenesis and carcinogenesis studies. Such assays would fill the void between human mutagenicity and the data that exist from short-term tests and from mutagenicity in other species. This paper discusses the following possible human cellular assays: (1) HPRT (hypoxanthine phosphoribosyltransferase) somatic cell mutation based on 6-thioguanine resistance; (2) hemoglobin somatic cell mutation assay; (3) glycophorin somatic cell mutation assay; and (4) LDH-X sperm cell mutation assay. 18 references.

38623 **Identification of benz[g]isoquinoline-5, 10-dione as an insect teratogen in commercial acridine.** Ma, C.Y.; Ho, C.; Walton, B.T.; Kao, G.L.; Guerin, M.R. (Oak Ridge National Lab., TN). *Environmental Science and Technology;* **18**: No. 5, 362-364(May 1984). Contract W-7405-ENG-26.

Benz[g]isoquinoline-5,10-dione is shown to be a primary contributor to the insect teratogenicity associated with commercial reagent-grade acridine. Confirmation is based upon spectroscopic, chromatographic, and bioassay results. The contribution of this chemical to coal oil insect teratogenicity is questioned.

38624 **Comparison of methods for evaluation of experimentally induced emphysema.** Busch, R.H.; Buschbom, R.L.; Smith, L.G. (Pacific Northwest Lab., Richmond, WA). *Environmental Research;* **33**: No. 2, 473-496(Apr 1984). Contract AC06-76RL01830.

Four methods to quantify induced emphysema, in a manner economically applicable to large numbers of animals, are compared by correlation analyses. Lung tissue used was from rats pretreated intratracheally with elastase or saline prior to exposure to air or $(NH_4)_2SO_4$ or NH_4NO_3 aerosols. The most sensitive quantitative evaluation was from mean chord length (MCL) measurements on scanning electron micrographs (SEM). Four-corner and parallel-line grids provided similar results, and reducing sample size to one selected field per lobe yielded a high degree of reliability for MCL measurements. Alveolar-pore perimeter and area (also measured on SEM photographs) were increased by induced emphysema, but were not reliable indicators for degree of pulmonary involvement.

Both subjective score (grading the degree of emphysema) and percentage-area-affected determinations indicated the presence of emphysema, but with less sensitivity than MCL measurements. However, these two subgross methods (performed with a dissecting microscope) provided valuable information on the distribution of pulmonary lesions; emphysema was induced in a nonuniform but consistent and progressive pattern in the two lobes of the lung studied. 23 studied.

38625 **Effects of ammonium sulfate aerosol exposure on lung structure of normal and elastase-impaired rats and guinea pigs.** Busch, R.H.; Buschbom, R.L.; Cannon, W.C.; Lauhala, K.E.; Miller, F.J.; Graham, J.A.; Smith, L.G. (Pacific Northwest Lab., Richland, WA). *Environmental Research;* **33**: No. 2, 454-472(Apr 1984). Contract AC06-76RL01830.

Rats and guinea pigs, pretreated with intratracheally administered elastase or saline, were exposed to 1.03 mg/m^3 $(NH_4)_2SO_4$; MMAD, 0.42 μm. Identically treated controls were sham exposed. Measurements and evaluation of structural changes were conducted using morphometric techniques on SEM photographs and by applying subjective ratings. Pathology studies were conducted by light and electron microscopy. All examination methods confirmed elastase-induced emphysema, which was aggravated by $(NH_4)_2SO_4$ exposure in the rat. Ammonium sulfate exposure of saline-treated animals produced measurable degrees of enlargement of alveoli, and alveolar ducts and sacs. Electron microscopy revealed increased interstitial collagen in affected lung areas of elastase-treated, $(NH_4)_2SO_4$-exposed animals. Alveolar-pore size was significantly increased in elastase-treated animals (control and exposed) but not in saline-treated, exposed animals. The data suggest a possible difference between elastase and $(NH_4)_2SO_4$ in the mechanisms responsible for the increased diameter of alveolar structures. Hypertrophy and hyperplasia of nonciliated epithelial cells of the small airways and of the Type II alveolar cells were observed in otherwise untreated guinea pigs exposed to $(NH_4)_2SO_4$ but not in elastase-treated guinea pigs, nor in any of the rats. 12 references.

38626 **Percutaneous absorption of [7.10-^{14}C]benzo[a] pyrene and [7,12-^{14}C]dimethylbenz[a]anthracene in mice.** Sanders, C.L.; Skinner, C.; Gelman, R.A. (Pacific Northwest Lab., Richland, WA). *Environmental Research;* **33**: No. 2, 353-360(Apr 1984). Contract AC06-76RL01830.

The percutaneous penetration, tissue distribution, and excretion of ^{14}C-labeled benzo[a]pyrene (BaP) and dimethylbenz[a]anthracene (DMBA) were studied in mice. Both BaP and DMBA rapidly penetrated the skin and were excreted more in the feces than in the urine. The proportion of BaP or DMBA absorbed was less with increasing applied dose due to apparent saturation of the uptake process. Uptake from the dorsal skin of the nose was similar to uptake from the dorsal nuchal skin. 24 references.

38627 **Reduction of sister chromatid exchange frequency with time after mutagen exposure in Chinese hamster ovary cells in the presence of 3-aminobenzamide.** Schwartz, J.L.; Morgan, W.F.; Wolff, S. (Univ. of California, San Francisco). *Environmental Mutagenesis;* **6**: No. 2, 203-210(1984).

3-Aminobenzamide (3AB) is a potent inhibitor of poly(ADP-ribose) synthesis and has been reported to inhibit DNA repair. Inhibition of poly(ADP-ribose) synthesis by 3AB results in a potentiation of the cytotoxic effects of alkylating agents and synergistically increases the frequency of sister chromatid exchanges (SCEs) induced in Chinese hamster ovary cells by methyl methanesulfonate (MMS). Experiments were carried out to determine if this synergism was related to an inhibition of the repair or the removal of SCE-forming lesions by 3AB. Cells were treated with MMS or ethyl nitrosourea (ENU) and either held in a nonproliferative state or maintained in exponential growth for up to 48 hr before SCE frequencies were measured. During this time, the SCE frequency decreased greatly. 3AB did not affect this decrease in either cycling or noncycling cells. Furthermore, 3AB appears to exert its effect only in cycling cells when bromodeoxyuridine is present. Therefore, the synergism between 3AB and alkylating agents in the induction of SCEs is unrelated to effects of 3AB on the repair or removal of SCE-forming lesions.

38628 **Somatic mutation and recombination test in Drosophila melanogaster.** Graf, U.; Wuergler, F.E.; Katz, A.J.; Frei, H.; Juon, H.; Hall, C.B.; Kale, P.G. (Univ. of Zurich, Schwerzenbach, Switzerland). *Environmental Mutagenesis;* **6**: No. 2, 153-188(1984).

A novel test system for the detection of mutagenic and recombinogenic activity of chemicals is described in detail. Drosophila melanogaster larvae trans-heterozygous for the mutations multiple wing hairs (mwh) and flare (flr) are exposed to the test compounds for various periods of time ranging from 96 hr to 1 hr. Induced mutations are detected as single mosaic spots on the wing blade of surviving adults that show either the multiple wing hairs or flare phenotype. Induced recombination leads to mwh and flr twin spots and also to a certain extent, to mwh single spots. Recording of the frequency and the size of the different spots allows for a quantitative determination of the mutagenic and recombinogenic effects. This and earlier studies with a small set of well-known mutagens indicate that the test detects monofunctional and polyfunctional alkylating agents (ethyl methanesulfonate, diepoxybutane, mitomycin C, Trenimon), mutagens forming large adducts (aflatoxin B_1), DNA breaking agents (bleomycin), intercalating agents (5-aminoacridine, ICR-170), spindle poisons (vinblastine), and antimetabolites (methotrexate). In addition, the test detects mutagens unstable in aqueous solution (β-propiolactone), gaseous mutagens (1,2-dibromoethane), as well as promutagens needing various pathways of metabolic activation (aflatoxin B_1, diethylnitrosamine, dimethylnitrosamine, mitomycin C, and procarbazine). The rapidity and ease of performance as well as the low costs of the test necessitate a high priority for validation of this promising Drosophila short-term test.

38629 **Pathology of acute inhalation exposure to 3-methylfuran in the rat and hamster.** Haschek, W.M.; Morse, C.C.; Boyd, M.R.; Hakkinen, P.J.; Witschi, H.P. (Oak Ridge National Lab., TN). *Experimental and Molecular Pathology;* **39**: No. 3, 342-354(Dec 1983).

The acute inhalation toxicity of 3-methylfuran (3MF) was investigated in SPF Fischer-derived and CD/CR rats, and golden Syrian hamsters by determination of the 2-week LC50, and by histologic examination of animals killed 1, 3, and 14 days following a 1-hr exposure to 148 and 322 mumole 3MF/liter for CD/CR rats and hamsters, respectively. The Fischer-derived rat was more sensitive to 3MF-induced lethality than the CD/CR rat with an LC50 in the male rat of 81 mumole/liter-1 hr as compared to 222 mumole/liter-1 hr. No sex difference was found. The hamster was relatively resistant with no lethality at 322 mumole 3MF/liter-2 hr. Pulmonary damage was present in both species. In the hamster, selective necrosis of nonciliated bronchiolar epithelial (Clara) cells was seen at 1 day with virtually complete regeneration by 14 days whereas in the rat the bronchiolar epithelial damage was more extensive and was followed by scattered peribronchiolar fibrosis and epithelial mucous metaplasia suggestive of "small airway disease" of man. Relatively selective 3MF-induced necrosis of olfactory epithelium occurred in the nasal mucosa of both species. Resolution of this lesion was seen by 14 days in the hamster. In the rat, however, the necrosis was much more extensive and was followed by partially occlusive fibrosis of the nasal cavity as seen at 14 days. 3MF also induced centrilobular hepatic necrosis in both species. In the rat, lymphocyte necrosis in the thymus and spleen, and esophageal necrosis was also seen.

38630 **Toxicological effects on mice following inhalation exposures to fluidized-bed coal combustor fly ash.** Kirchner, F.R.; Reilly, C.A. Jr.; Buchholz, D.M.; Pahnke, V.A. Jr. (Argonne National Lab., IL). *Environmental Research;* **32**: No. 2, 314-328(Dec 1983). Contract W-31-109-ENG-38.

Toxicological effects of exposure to reaerosolized fly ash from a fluidized-bed coal combustor were evaluated in mice following 500- and 1000-hr inhalation exposures. Alveolar macrophage function, organ histology, and hematopoiesis were assessed following 24-hr/day exposures in two 500-hr experiments. There was little mutagenicity detected by the Ames assay in the samples of the fly ash tested. The chemical characteristics of the fly ash were very similar to those of fly ash produced during conventional coal combustion. However, physical characterization revealed that fluidized-

bed combustion fly ash was not fused as is commonly the case in conventionally combusted fly ash, and as a result had a very large surface area. The function of the alveolar macrophages of exposed mice was impaired, and there were significant changes in the histology of the lung, including cellular infiltration and hyperplasia of bronchiolar and alveolar epithelium. These changes are characteristic of pulmonary responses to chronic irritation of the lung.

38631 **Unifying concept for carcinogenic risk assessments.** Jones, T.D.; Griffin, G.D.; Walsh, P.J. (Oak Ridge National Lab., TN). *Journal of Theoretical Biology;* **105**: 35-61(1983). Contract W-7405-ENG-26.

The quantification of carcinogenic potentiation may derive from a common-index-quantity estimated according to enhanced cell proliferation resulting from cytotoxicity or toxic hyperplasia induced by a specific exposure. At this time, it is not possible to define, in a restrictive sense, the molecular events which are critical to potentiation but the processes of cell proliferation resulting from cytotoxicity/hyperplasia seem to serve as indices which contain the necessary (and perhaps several secondary) biological responses. The unique advantage is that cell-culture, animal, and human-level studies can be used to evaluate certain parameters of the mathematical model for an untested treatment protocol or chemical insult suspected to be a cofactor in tumorigenesis. The main thrust of this paper is to propose that tumorigenesis should be studied in terms of cellular-population kinetics in response to a biological challenge rather than according to chemical or energetic parameters of that challenge. This approach leads to mathematical equations which can serve as a unifying concept for carcinogenic risk assessments. Sample results, to illustrate the utility of this model, are given for polynuclear aromatic hydrocarbons, trace metals, ionizing radiations, CO, NO, SO_2, O_3, and NO_2. Treatment, here, is for acute exposure conditions, but because the model is mechanistic, other exposure protocols can be addressed by simply adjusting some of the mathematical parameters according to factors estimated from a relative potency comparison of in vitro and in vivo studies best suited to the particular application of interest. A mathematical approximation of the model is included in the appendix.

38632 **Cd^{2+} responses of cultured human blood cells.** Enger, M.D.; Hildebrand, C.E.; Stewart, C.C. (Los Alamos National Lab., NM). *Toxicology and Applied Pharmacology;* **69**: 214-224(1983).

Cd^{2+} cytotoxicity, uptake, and partitioning, and Cd^{2+}-induced metallothioneine synthesis were studied in cultured peripheral human blood cells. Mononuclear cells were found to resist relatively high levels of Cd^{2+}. Few cells were killed below 50 μM Cd^{2+}. Above this value, survival decreased exponentially with dose. The mean LD50 for mononuclear cells cultured in Cd^{2+} for 40 hr was 100 μM. Polymorphonuclear cells (granulocytes) were found to be more resistant, with a significantly higher threshold and LD50, and a more complex dose response. Most of the Cd^{2+} incorporated by blood cells was taken up by nucleated cells. Despite their greater resistance, polymorphonuclear cells incorporated more Cd^{2+} at higher doses (50 to 150 μM) than did mononuclear cells. No Cd^{2+} was bound to metallothioneine in polymorphonuclear cells following exposure to Cd^{2+} for even extended periods of time (18 hr) at high doses of $^{109}Cd^{2+}$ (25 μM). Instead Cd^{2+} appeared in a Sephadex G-75 peak of approximately 60,000 Da, as well as in the void peak. No significant amount of preexisting metallothioneine (MT) or metallothioneine mRNA was found in the mononuclear cells. However, MT synthesis was induced rapidly following exposure to Cd^{2+}. [$^{109}Cd^{2+}$]MT appeared within 1 hr following exposure to 50 μM $^{109}Cd^{2+}$, and MT synthesis rates measured from [^{35}S]cysteine incorporation were found to be maximal within 4 hr.

38633 **Clastogenic effects of transplacental exposure of mouse embryos to nitrogen mustard of cyclophosphamide.** Meyne, J.; Legator, M.S. (Los Alamos National Lab., NM). *Teratogenesis, Carcinogenesis, and Mutagenesis;* **3**: 281-287(1983).

Embryos from day 12 pregnant Swiss mice given intraperitoneal injections of nitrogen mustard (HN_2) or cyclophosphamide (CP) were evaluated for chromosomal aberrations. Both agents induced dose-dependent increases in the frequency of cells with aberrations observed in embryos from females treated 6 hr before sacrifice. The highest frequencies of cells with aberrations were observed when females were injected 15 or 18 hr before sacrifice on day 12. A teratogenic dose of HN_2 (1.0 mg/kg) induced significantly higher frequencies of damaged cells than a teratogenic dose of CP (20 mg/kg). Cytogenetic analysis of rodent embryos from pregnant females exposed to xenobiotic agents may be an effective screening test for evaluation of genetic effects induced by transplacental exposure.

38634 **Toxicological effects on mice following inhalation exposures to fluidized-bed coal combustor fly ash.** Kirchner, F.R.; Reilly, C.A. Jr.; Buchholz, D.M.; Pahnke, V.A. Jr. (Argonne National Lab., IL). *Environmental Research;* **32**: 314-328(1983). Contract W-31-109-ENG-38.

Toxicological effects of exposure to reaerosolized fly ash from a fluidized-bed coal combustor were evaluated in mice following 500- and 1000-hr inhalation exposures. Alveolar macrophage function, organ histology, and hematopoiesis were assessed following 24-hr/day exposures in two 500-hr experiments. There was little mutagenicity detected by the Ames assay in the samples of the fly ash tested. The chemical characteristics of the fly ash were very similar to those of fly ash produced during conventional coal combustion. However, physical characterization revealed that the fluidized-bed combustion fly ash was not fused as is commonly the case in conventionally combusted fly ash, and as a result had a very large surface area. The function of the alveolar macrophages of exposed mice was impaired, and there were significant changes in the histology of the lung, including cellular infiltration and hyperplasia of bronchiolar and alveolar epithelium. These changes are characteristic of pulmonary responses to chronic irritation of the lung.

38635 **Report of the U.S. Environmental Protection Agency Gene-Tox Program.** Mitchell, A.D.; Casciano, D.A.; Meltz, M.L.; Robinson, D.E.; San, R.H.C.; Williams, G.M.; Von Halle, E.S. (SRI International, Menlo Park, CA). *Mutation Research;* **123**: 363-410(1983). Contract W-7405-ENG-26.

The utility of unscheduled DNA synthesis (UDS) testing for screening potentially hazardous chemicals was evaluted using the published papers and technical reports available to the UDS Work Group. A total of 244 documents were reviewed. Based on criteria defined in advance for evaluation of the results, 169 were rejected. From the 75 documents accepted, results were reviewed for 136 chemicals tested using autoradiographic approaches and for 147 chemicals tested using liquid scintillation counting (LSC) procedures; 38 chemicals were tested by both approaches to measure UDS. Since there were no documents available that provided detailed recommendations of UDS screening protocols or criteria for evaluating the results, the UDS Work Group presents suggested protocols and evaluation criteria suitable for measuring and evaluating UDS by autoradiography in primary rat hepatocytes and diploid human fibroblasts and by the LSC approach in diploid human fibroblasts. UDS detection is an appropriate system for inclusion in carcinogenicity and mutagenicity testing programs, because it measures the repair of DNA damage induced by many classes of chemicals over the entire mammalian genome. However, for this system to be utilized effectively, appropriate metabolic activations systems for autoradiographic measurements of UDS in human diploid fibrobalsts must be developed, the nature of hepatocyte-to-hepatocyte variability in UDS responses must be determined, and the three suggested protocols must be thoroughly evaluated by using them to test a large number of coded chemicals of known in vivo mutagenicity and carcinogenicity.

38636 **Risk assessment by analysis of extrapolation error: a demonstration for effects of pollutants on fish.** Suter, G.W. II.; Vaughan, D.S.; Gardner, R.H. (Oak Ridge National Lab., TN). *Environmental Toxicology and Chemistry;* **2**: 369-378(1983). Contract W-7405-ENG-26.

This article describes a new method for risk assessment and applies it to assessing the risk of chronic toxicity of mercury to largemouth bass. The method consists of extrapolation between taxa and between toxicity test types by regression analysis. The variance terms in the regression analyses are combined with the point estimate of the geometric mean of the maximum allowable toxic con-

centration (GMATC) to derive a probability distribution of the GMATC. This distribution is then compared to the ambient contaminant concentration to derive the probability or risk of chronic toxicity. This general approach to risk analysis is applicable to any organism or toxicant.

38637 **Differential ozone susceptibility of Centennial Russet and White Rose potato as demonstrated by fumigation and antioxidant treatments.** Foster, K.W.; Guerard, J.P.; Oshima, R.J.; Bishop, J.C.; Timm, H. (Univ. of California, Riverside). *American Potato Journal;* **60**: 127-139(1983).

Because quantitative field estimates of potato (Solanum tuberosum L.) yield losses attributable to ozone (O_3) air pollution damage in California need to be assessed, the antioxidant compound N-[-2-(2-oxo-1-imidazo-lidinyl)ethyl]-N'-phenylurea (EDU or DPX-4891) was evaluated for suitability in estimating these yield losses and in differentiating O_3-susceptible from O_3-resistant cultivars. Differential susceptibility of two cultivars, 'Centennial Russet' (O_3-sensitive) and 'White Rose' (O_3-resistant), to O_3 was confirmed in greenhouse experiments. In the absence of O_3 under greenhouse conditions, EDU had no observable effect on shoot dry weight, tuber number, or tuber yield of either cultivar, suggesting that EDU does not materially affect plant growth in the absence of O_3 at the treatment levels used and under the conditions herein. In field experiments, EDU applied at the highest rate, 17.8 kg/ha, increased marketable and total tuber yields of Centennial Russet by 208 and 188 q/ha, respectively, and increased specific gravity by 0.013. White Rose was not affected by EDU.

38638 **Environmental effects of utilization of sewage sludge for biomass production.** Corey, J.C.; Hollod, G.J.; Stone, D.M.; Wells, C.G.; McKee, W.H.; Bartell, S.M. (EI du Pont de Nemours & Co., Savannah River Lab., Aiken, SC). pp 266-273 of Land reclamation and biomass production with municipal wastewater and sludge. Sopper, W.E.; Seaker, E.M.; Bastian, R.K. (eds.). University Park, PA; Pennsylvania State University Press (1982). (CONF-8009329—).

From Symposium on land reclamation and biomass production with municipal wastewater and sludge; Pittsburgh, PA, USA (16 Sep 1980).

Environmental effects of application rate, season, frequency, and method (surface versus incorporation) of sewage sludge will be investigated on four ages of loblolly pine (Pinus taeda) on two soil types. The stands were planted in 1953, 1972, 1978 and 1981, on moderately heavy and light texture soils. Sludge will be applied at application rates equivalent to 275 and 500 kg/ha as total nitrogen. Environmental effects and coppice growth response by hardwoods with and without sewage sludge also are being examined. Nutrient cycling and groundwater quality for plantings of red maple (Acer rubrum), sweet gum (Liquidamber styraciflua L.), american sycamore (Platanus occidentalis L.), black locust (Robinia pseudoacacia), and black alder (Alnus glutinosa) will be measured with sludge applications of 275 and 550 kg/ha of nitrogen. 12 references.

38639 **Effects of aminoacetonitrile on net photosynthesis, ribulose-1,5-bisphosphate levels, and glycolate pathway intermediates.** Creach, E.; Stewart, C.R. (Iowa State Univ., Ames). *Plant Physiology;* **70**: 1444-1448(1982). Contract AC02-80ER10685.

The effects of aminoacetonitrile (a competitive inhibitor of glycine oxidation) on net photosynthesis, glycolate pathway intermediates, and ribulose-1,5-bisphosphate (RuBP) levels have been investigated at different O_2 and CO_2 concentrations with soybean leaf discs floated on 25 millimolar aminoacetonitrile (AAN) for 50 minutes prior to assay. At 11% to 60% O_2, AAN caused a decrease in net photosynthesis in addition to the inhibition by O_2. This extra inhibition ranged from 22% to 59% depending on the O_2 and CO_2 concentrations. The levels of RuBP, however, were 1.3 to 2.7 times higher than in the control plants at the same O_2 concentrations . At 40% O_2 and 200 microliters per liter CO_2 the inhibitor caused a 6-fold increase in glycine and more than 2-fold increase in glyoxylate levels, whereas those of glycolate decreased by approximately one-half. The decrease in net photosynthesis observed with AAN is not the result of the depletion of the RuBP pool due to the lack of recycling of carbon from the glycolate pathway to the Calvin cycle. The higher levels of RuBP caused by AAN in photorespiratory conditions, suggest that RuBP carboxylase was inhibited. Glyoxylate could be a possible candidate for the inhibition of the enzyme but what is know so far about its inhibitory properties in vitro may not fit the existing in vivo conditions. An alternative explanation for the inhibition is proposed.

38640 **(LA-tr—84-29) What effect has the deficiency of one nutrient on SO_2 resistance of 1-year-old pines.** Enderlein, H.; Kaestner, W. Translated from *Archiv fuer Forstwesen ;* **16**: No. 5, 431-435(1967). Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015350. DE84015350

Experimental exposure of 1-year old scots pines, growing on model soils variously deficient in the mean nutrients N, P, K, Ca and Mg, produced during different long periods of exposure to gas at different concentrations of SO_2 very distinct differences in sensitivity of the pines to flue gas due to deficiency of a nutrient. All the tests showed that a lack of nitrogen decisively increases the sensitivity of the pines to SO_2. With an increasing effect of SO_2 and increased damages due to it, the importance of a nitrogen deficiency grows. 2 references.

5604 Other Environmental Pollutant Effects

38641 **Effect of laser microbeam irradiation of the nucleus on the cleavage of mouse eggs in culture.** Lin, T.P.; Chan, J.Y. (Univ. of California, San Francisco). *Radiation Research;* **98**: No. 3, 549-560(Jun 1984). Contract AM03-76SF00034.

Two-cell mouse eggs were irradiated by a helium-cadmium laser on a spot of about 4 μm^2 in one or both nuclei either continuously or repeatedly at 0.36 erg μm^{-2} sec^{-1} and then cultured to observe cellular development. After exposing one nucleus to the microbeam to five or seven 1-sec pulses, about 45% developed to the 3-cell stage in 24 hr of culture. In overnight cultures of the 2-cell eggs in which both nuclei were irradiated for 9 or 20 sec continuously, 40 (9 sec) and 50% (20 sec) of the eggs remained at the 2-cell stage, while 45 (9 sec) and 25% (20 sec) developed to the 4-cell stage. When both nuclei were each irradiated by a 9-sec continuous laser beam (totaling 13 ergs), about 40% of the embryos of the 2-cell stage did not divide. The effect of seven pulses on the blastomere cleavage of 2-cell mouse eggs appeared to be comparable to that of continuous 9-sec laser irradiation. Both pulse and continuous laser microirradiation methods may be developed for inactivation of the nucleus as a nonpipetting, less injurious method for enucleation of mammalian eggs.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 57000037170, 38561, 38594

38642 **(DOE/PE—0055) Environment, safety and health at DOE facilities. Annual report, calendar year 1982.** (USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC). 1982. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84014819.

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The DOE has set forth its basic environmental, safety, and health policy and program requirements in Order DOE 5480.1, Environmental Protection, Safety, and Health Protection Program for DOE Operations. Additional orders address specific areas within the ES and H programs. The program was established to protect the health and safety of approximately 132,000 contractor employees, the general public, DOE property which has a replacement value of about $66 billion, and the natural environment from harm that could result from DOE operations. This report is a review of the 1982 environmental, safety, and health performance for the US Department of Energy's (DOE) federal contractor operations, as presented by the Office of the Assistant Secretary for Policy, Safety, and Environment. 26 figures, 8 tables.

38643 **(PB—84-168640) Long-term, Self-contained, Chemical Protective Ensemble.** Royer, M.D.; Turpin, R.D.; Druyor, D.D.; Kranz, M. (Environmental Protection Agency, Cincinnati, OH (USA). Municipal Environmental Research Lab.). 1984. 21p. (EPA—600/D-84-084). NTIS, PC A02/MF A01.

Sponsored in part by Chemical Research and Development Center, Aberdeen Proving Ground, MD. Prepared in cooperation with U.S.D. Corp., Santa Ana, CA.

A Joint U.S. Environmental Protection Agency (EPA)/ Army project is in progress to produce a Long-term (2.5-hr), Self-contained, Chemical Protective Ensemble (LSCPE) with a NIOSH-certified breathing apparatus. The LSCPE provides the wearer with a combination of assets including mobility, air supply duration of 2.5 hours, cooling capacity, and protection from chemical exposure. The LSCPE outergarment is totally encapsulating, has a zipper-closure, and is constructed of chlorinated polyethylene. The 'gathered' areas that encircle the waist and knees enable the inside volume of the suit to expand temporarily during normal movements.

38644 **(UCID—20126) Safety analysis of the nuclear chemistry Building 151.** Kvam, D. (Lawrence Livermore National Lab., CA (USA)). 29 Jun 1984. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015469.

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This report summarizes the results of a safety analysis that was done on Building 151. The report outlines the methodology, the analysis, and the findings that led to the low hazard classification. No further safety evaluation is indicated at this time. 5 tables.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 58010037101, 37259, 37297, 37298, 37300, 37301, 37302, 37303, 37304, 37305, 37306, 37308, 37309, 37310, 37311, 37312, 37313, 37324, 37325, 37341, 37342, 37343, 37345, 37347, 37728, 38422

38645 **(LA—9445-PNTX-I) Supplementary documentation for an Environmental Impact Statement regarding the Pantex Plant: geohydrology.** Purtymun, W.D.; Becker, N.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008068.

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This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. The Pantex Plant is located in Carson County on the Southern High Plains of West Texas. The report presents regional geology, geologic structure, and hydrology along with detail geology and hydrology at and adjacent to the Pantex Plant. The Ogallala Formation forms the upper surface of the High Plains and contains the principal aquifer. Water from the aquifer is pumped for municipal, industrial, and agricultural supply. The past water production and future water supply for the plant are discussed. Also, the annual water requirements for the County are projected along with hydrologic effects on the aquifer at and adjacent to the plant until the year 2020. The chemical quality of surface and ground water is presented. A brief description is given of sanitary landfill operations at the plant and natural resources of the adjacent area. Geologic and hydrologic hazards in the area are discussed.

38646 **(USGS/MAP/I—451) Map showing relation of land and submarine topography, Nova Scotia to Florida.** Uchupi, E. (Geological Survey, Reston, VA (USA)). 1965. 51p. NTIS, PC A04/MF A01. Order Number DE84901480.

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These three maps show the topography of the east coast of the United States and Canada, showing the relationship of terrestrial and submarine topography. (ACR)

38647 **Topographic amplification of tectonic displacement: Implications for geodetic measurement of strain changes.** McTigue, D.F.; Stein, R.S. (Fluid Mechanics and Heat Transfer Division I, Sandia National Laboratories). *Journal of Geophysical Research;* **89**: No. B2, 1123-1131(10 Feb 1984).

Correlations of level changes with topography demand an assessment of the effect of an irregular free boundary on surface deformation. This is examined through a plane strain elastic model with topography of small slope, subjected to a change in the far-field horizontal stress. To leading order, vertical surface displacements due to the topographic perturbation are proportional to the local relief. Elevation-dependent uplift results from a compressional change, and downdrop results from a tensional change. The model further predicts that the ratio of elevation change to elevation is proportional to and of the same order of magnitude as the regional strain. Horizontal strains are locally perturbed by topography as well, with the magnitude scaling with the local slope.. The predicted localization of level changes is very small in aseismic regions and cannot contribute significantly to measured correlations. A test case in southern California bears this out, with strains of order 10^{-6} accompanied by elevation change to elevation ratios of order 10^{-4}. Releveling following the Nankaido-Tonankai earthquakes, which induced large coseismic and postseismic strains, reveals scattered examples of elevation-dependent level changes. However, when compared to modeled strains, the correlations are again at least an order of magnitude larger than the localization effect predicted by the elastic model. Although the topographic perturbation of vertical displacements appears to be unmeasurably small, local variations in horizontal strain or borehole dilatation across steep relief may be discernible with current technology.

38648 **Acoustic emission/microseismic activity in geologic structures and materials.** Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal-Zellerfield, West Germany; Trans Tech Publications (1984). 814p. (CONF-811036—). Karl Distributors, 16 Bearskin Neck, Rockport, MA 01966.

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

Forty-six papers were presented at the conference. A separate abstract was prepared for 25 of the papers. One paper had been previously included in the data base. The remaining 20 papers were not in scope for EDB.

38649 **Monitoring of acoustic emissions during the uniaxial deformation of large samples.** Sondergeld, C.H.; Estey, L.H.; Halleck, P.M.; Dey, T.N.; Blacic, J.D. (Los Alamos National Lab., NM). *Series on Rock and Soil Mechanics;* **8**: 147-158(1984). (CONF-811036—).

From 3. conference on acoustic emission/microseismic activity in geologic structures and materials; University Park, PA, USA (5 Oct 1981).

Acoustic emissions were monitored during the deformation of large samples of Texas pink granite. A 44 MN loading frame at Los Alamos National Laboratory was used to uniaxially compress the samples. Hypocenters and focal mechanisms were determined for some of the AE events. Hypocenters displayed a strong spatial clustering in areas of maximum stress. A composite focal mechanism (304 arrivals) was consistent with a nonuniformly applied load and the resultant tensional deformation. Polarity and amplitude measurements are consistent with a double couple source mechanism. Event statistics over these volumes are difficult to interpret as they correspond to local and not bulk deformation of the sample.

5802 Geophysics

REFER ALSO TO CITATION(S) 58020037259

38650 (BMFT-FB-T—84-084) Computation of reflexion seismograms for media with lateral inhomogenity. Hubral, P. (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751907.

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A comprehensive computer program has been developed to improve the interpretation of reflection seismic measurements. It is based on the simulation of P, S, and converted waves in a three-dimensional medium of curved layers simulating real geological conditions. The calculation of the waves is done on the basis of asymptotic ray theory. The procedure makes it possible to describe high-frequency wave fields by precisely determining a) the geometric divergency along the seismic rays and b) the reflection and transmission behaviour at layer boundaries. Even for complex geological structures, the program can calculate selected waves very rapidly. The program will be used for solving various problems of seismic interpretation, for planning data acquisition, and for processing of seismic data.

38651 (HIG—83-3) Archiving and exchange of a computerized marine seismic database: the ROSE data archive system. LaTraille, S.L. (Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). Dec 1983. 145p. NTIS, PC A07/MF A01. Order Number DE84901453.

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A central data exchange facility was organized at Hawaii Institute of Geophysics to manage seismic data collected during project ROSE (the Rivera Ocean Seismic Experiment), a large marine seismic experiment. Prior to that experiment, wide consultation was made and much effort was expended in the establishment of a uniform, yet flexible, data exchange format. The participating institutions provided their data to the facility where the data were catalogued and distributed. This report describes in detail the processes and computer programs used to catalog, store and distribute the ROSE seismic data. 3 references, 3 figures, 5 tables.

38652 (N—8329894) Reports on crustal movements and deformations. Cohen, S.C.; Peck, T. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 170p. (NASA-TM—85041). NTIS, PC A08/MF A01.

This Catalog of Reports on Crustal Movements and Deformation is a structured bibliography of scientific papers on the movements of the Earth crust. The catalog summarizes by various subjects papers containing data on the movement of the Earth's surface due to tectonic processes. In preparing the catalog we have included studies of tectonic plate motions, spreading and convergence, microplate rotation, regional crustal deformation strain accumulation and deformations associated with the earthquake cycle, and fault motion. We have also included several papers dealing with models of tectonic plate motion and with crustal stress. Papers which discuss tectonic and geologic history but which do not present rates of movements or deformations and papers which are primarily theoretical analyses have been excluded from the catalog. An index of authors cross-referenced to their publications also appears in the catalog. The catalog covers articles appearing in reviewed technical journals during the years 1970-1981. Although there are citations from about twenty journals most of the items come from the following publications: Journal of Geophysical Research, Tectonophysics, Geological Society of America Bulletin of the Seismological Society of America, Nature, Science, Geophysical Journal of the Royal Astronomical Society, Earth and Planetary Science Letters, and Geology.

38653 (SAND—83-2638C) Models for volcanic processes in Long Valley, California: testing by continental drilling. Rundle, J.B. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014943.

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This paper gives a brief review of recent tectonic activity in the Long Valley, California, caldera, occurring since 1978. A series of major earthquakes, combined with ground uplift, crustal strain, gravity changes, hydrothermal system changes, and earthquake swarm activity all suggest the recent existence of a significant high level magmatic intrusion as the root cause of the activity. These data are outlined here, along with a program to investigate the nature and current evolution of this active caldera system. Current activities and future plans are also discussed. 23 references, 5 figures.

38654 (UCID—20129) Analysis of the Goodnow, NY earthquake using RSTN data. Taylor, S.R. (Lawrence Livermore National Lab., CA (USA)). 20 Jul 1984. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015487.

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The Goodnow, NY earthquake of October 7, 1983 (m/sub b/ = 5.2) has been analyzed using P waves and Rayleigh waves recorded by the Regional Seismic Test Network (RSTN). The event occurred only 71 km from the station RSNY where seismogram clipping was observed on all three short-period and the mid-period vertical components for the L/sub g/ portion of the wavetrain. State-of-health information obtained from RSNY indicated that the seismometers did not clip, suggesting that the electronics in the passband shaping filters saturated. However, the P waves at RSNY appeared to be reliably recorded. This is confirmed by comparing P-wave moments from RSNY with those from the other RSTN stations obtained using both P waves and Rayleigh waves. The average P-wave moment (1.7×10^{23}) compares well with that estimated from the Rayleigh waves (2.1×10^{23}) and is in relatively good agreement with that obtained at RSNY (0.4×10^{23}). Synthetic seismograms calculated for RSNT are consistent with the fault geometry of Suarez et al. (1984). The focal mechanism was consistent with a N-S trending thrust, dipping 60°W, at a depth of 7 km with a fault radius of approximately 1.5 km that ruptured towards the surface. Although strong ground motion from a large, local earthquake may cause portions of the RSTN seismograms to clip, the diagnostics contained in the downhole package will generally allow users to evaluate the reliability of the unclipped data. 15 references, 10 figures, 1 table.

38655 Numerical Methods in Seismology. Chin, R.C.Y.; Hedstrom, G.; Thigpen, L. (Lawrence Livermore Laboratory, University of California, Livermore California 94550). *Journal of Computational Physics;* **54**: No. 1, 3-18(Apr 1984). Contract W-7405-ENG-48.

A survey is given of the numerical methods used for computing synthetic seismograms. In particular, the properties of finite differences, finite elements, integral transforms, and ray tracing are described. Each of these methods is capable of giving good results for its own range of frequencies and wave numbers. Thus, for complete seismograms, one should be prepared to use all of the available tools.

38656 Harper-dorn creep: An artifact of low-amplitude temperature cycling?. Weertman, J.; Blacic, J. (Center for Materials Science). *Geophysical Research Letters;* **11**: No. 2, 117-120(Feb 1984).

Harper-Dorn (HD) creep may be produced by inadvertent low-amplitude temperature cycling that is inevitable during high-temperature creep tests. A cyclic temperature change causes a cyclic change in the equilibrium point defect concentration. In turn, a cyclic chemical force on dislocations that produces climb motion is created because the actual point defect concentration can never exactly equal the instantaneous equilibrium value. A cyclic +- 1 K can produce a maximum chemical stress of +- 5 MPa. When the period of the cycling is neither very large nor very small and the chemical stress is larger than the applied mechanical stress it, rather than the mechanical stress, determines the dislocation density. In this case, the dislocation density is independent of the applied stress. Therefore, the creep rate is proportional to the applied stress and is independent of grain size, the characteristics of HD creep. If this explanation of HD creep is correct this type of creep will not

occur in the earth's mantle and will not serve as a mechanism for Newtonian mantle viscosity.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 58030037196, 37206, 37263, 37281, 37329, 37336, 37337

38657 **(UCRL—89960) Blind zones and aspect ratio bias in acquisition of discontinuity orientation data.** Yow, J.L. Jr. (Lawrence Livermore National Lab., CA (USA)). 27 Oct 1983. Contract W-7405-ENG-48. 9p. (CONF-840633—1). NTIS, PC A02/MF A01. Order Number DE84002718.

From 25. US symposium on rock mechanics; Evanston, IL, USA (25 Jun 1984).

Characterizaion of discontinuities such as faults, shears, and joints in a rock mass is an integral part of many geotechnical data acquisition programs. Discontinuity orientations are in practice measures in rock core samples or are mapped from rock exposures. Data sets thus obtained are biased because of blind zones associated with each borehole or mapping surface. This paper quantifies the extent of blind zones and outlines a procedure for treating aspect ratio bias. 4 figures. (ACR)

38658 **The state of the art of numerical modeling of thermohydrologic flow in fractured rock masses.** Wang, J.S.Y.; Sterbentz, R.A.; Tsang, C.F. (Earth Sciences Division Lawrence Berkeley Laboratory University of California Berkeley, California). *Environmental Geology (New York);* **4**: No. 3/4, 133-200(1982).

The state of the art of numerical modeling of thermohydrologic flow in fractured rock masses is reviewed and a comparative study is made of several models which have been developed in nuclear waste isolation, geothermal energy, ground water hydrology, petroleum engineering, and other geologic fields. The general review is followed by individual summaries of each model and the main characteristics of its governing equations, numerical solutions, computer codes, validations, and applications.

5804 Geochemistry

38659 **(PNL—4881) Thermodynamic properties and environmental chemistry of chromium.** Schmidt, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015123.

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Values of standard entropy, standard enthalpy of formation, and standard free energy of formation for Cr and its solid and aqueous species are tabulated in this report. These values were selected or recalculated after careful evaluation of the best available current thermochemical data. The basis for selection of data centered on conformation with the recent studies of Vasil'ev et al. (1977a,b, 1978, 1980, 1981) for Cr^{3+} data and O'Hare and Boerio (1975) for CrO_4^{2-} data. The thermodynamic data presented in this report will be incorporated into the data base of the geochemical computer model, MINTEQ. The distribution of Cr in the environment among its aqueous inorganic species is, according to the thermodynamic data, highly dependent upon pH and Eh and the presence of complexing ligands. The speciation of Cr in natural waters is also controlled by reduction and complexation by organic matter, adsorption and oxidation by Mn-oxide in suspended particulate matter and sediment, and reduction by H_2S released from anoxic sediments. 89 references, 8 figures, 11 tables.

5805 Oceanography

REFER ALSO TO CITATION(S) 58050038383, 38646

64 PHYSICS. I.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 64010038337, 38793, 38793, 38864

38660 **(AD-A—138345/4) Rate of energy input in thermal solar flares. Technical report.** Feldman, U.; Doschek, G.A.; McKenzie, D.L. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 7 Dec 1983. 19p. (TR—0084(4940-01)-1). NTIS, PC A02/MF A01.

The rise phases of solar soft X-ray flares observed by X-ray crystal spectrometers on p78-1 are discussed in terms of the rate of change of X-ray flux as a function of time. It is shown that the flux increased exponentially over most of the rise time. The e-folding time TAU has a cut-off at 13 s. Soft X-ray flares with smaller values of TAU are not observed. It is suggested that this phenomenon is due to the ability of the solar atmosphere to absorb the input energy and convert it into a typical soft X-ray flare. For energy input rates that are below a certain critical value the temperature attained by the plasma is around 20,000,000 K, but for values above the critical value, the gas is heated to much higher temperatures T sub e > or = 10 to the 8th K, producing a certain class of hard X-ray events.

38661 **(AD-A—138377/7) Summary of whistlers observed by Voyager 1 at Jupiter. Progress report.** Kurth, W.S.; Strayer, B.D.; Gurnett, D.A.; Scarf, F.L. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). 20 Dec 1983. 39p. NTIS, PC A03/MF A01.

Prepared in cooperation with TRW Space and Technology Group, Redondo Beach, CA.

We summarize the Voyager 1 observations of whistlers at Jupiter in order to provide a basis for further analyses of the density profile of the Io plasma torus as well as to support studies of atmospheric lightning at Jupiter. All the whistlers detected by Voyager 1 fell into three general regions in the torus at radial distances ranging between 5 and 6 R sub J. An analysis of the broadband wave amplitudes measured by the Voyager 1 plasma wave instrument and estimates of the peak whistler amplitudes imply the grouping of whistlers was due to variations in the sensitivity of the receiver to whistlers and not to variations in the source or propagation paths of the whistlers. The whistler dispersions are presented in statistical form for each of the three groups of events and analyzed in view of the structure of the Io plasma torus as determined by plasma probe measurements. The results of these analyses give source locations for the whistlers at the foot of the magnetic field lines threading the torus in both hemispheres and over a range of longitudes.

38662 **(AD-A—140208/0) MHD (magnetohydrodynamic) simulation of a comet magnetosphere. Memorandum report.** Fedder, J.A.; Brecht, S.H.; Lyon, J.G. (Naval Research Lab., Washington, DC (USA)). 12 Apr 1984. 32p. (NRL-MR—5306). NTIS, PC A03/MF A01.

This paper presents results of a numerical magnetohydrodynamic simulation of the interaction of the solar wind with a comet. It states that for a steady solar wind and interplanetary magnetic field (IMF) the cometary plasma has a distinctive structure; a spheroidal head and a long ribbon-like tail. Rotational discontinuities in the IMF lead to changes in the tail structure. It is shown how these effects occur and describe ray-like structures as well as a tail disconnection event. The simulation results provide a simple explanation for a number of observable features in cometary plasma tails.

38663 (BNL—34995) Report on solar neutrino experiments. Davis, R. Jr.; Cleveland, B.T.; Rowley, J.K. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 14p. (CONF-8405193—28). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014567.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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A summary is given of the status of solar neutrino research that includes results of the Brookhaven chlorine detector, a discussion of the development of the gallium, bromine, and lithium radiochemical detectors, and some proposals for direct counting detectors. The gallium and bromine radiochemical detectors are developed and are capable of giving critical information of interest about neutrino physics and the fusion reactions in the interior of the sun. A plan for building these detectors is outlined and a rough cost estimate is given. A review is given of the plans in the Soviet Union in solar neutrino research.

38664 (N—8328019) Venera-13 mass spectrometer studies of atmospheric gases on Venus. Istomin, V.G. (Joint Publications Research Service, Arlington, VA (USA)). May 1983. 10p. NTIS, PC A07.

In USSR rept.: Space, No. 21 (JPRS-83430) p 56-65 (See N83-28011 17-12); Transl. from Zemlya i Vselennaya (Moscow), No. 5, Sep-Oct 1982 p 19-25.

Early in the morning of 1 March 1982, the descent vehicle of the Venera 13 station entered the dense layers of the planet's atmosphere. At an altitude of about 23 km above the surface of Venus, a mass spectrometer was turned on. The mass spectra being received was identified peaks of isotopes of neon-20 and neon-22. This information, received within less than 15 minutes after the instrument was turned on meant the isotopic composition of neon (one of the rare gases) was present in negligible amounts in the atmosphere of the planet that is our closest neighbor.

38665 (N—8329151) The need for an intermediate mass scale in GUTs. Shafi, Q. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 16p. (NASA-TM—85039; CONF-830231—10). NTIS, PC A02/MF A01.

From Europhysics study conference on electroweak effects at high energies; Erice, Italy (1 Feb 1983).

The minimal SU(5) grand unified field theory (GUT) model fails to resolve the strong charge parity (CP) problem, suffers from the cosmological monopole problem, sheds no light on the nature of the 'dark' mass in the universe, and predicts an unacceptably low value for the baryon asymmetry. All these problems can be overcome in suitable grand unified axion models with an intermediate mass scale of about 10 to the 11th power to 10 to the 12th power GeV. An example based on the gauge group SO(10) is presented. Among other things, it predicts that the axions comprise the 'dark' mass in the universe, and that there exists a galactic monopole flux of 10 to the -8th power to 10 to the -7th power/sq cm/yr. Other topics that are briefly discussed include proton decay, family symmetry, neutrino masses and the gauge hierarchy problem.

38666 (N—8329152) On neutron star structure and the millisecond pulsar. Harding, A.K. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 11p. (NASA-TM—85040). NTIS, PC A02/MF A01.

The recently discovered millisecond pulsar (PSR1937-214) is observed to be rotating close to the limit of dynamical instability for a neutron star. Despite its extremely rapid rotation, measurements of the period derivative put a stringent upper limit on the energy loss from gravitational radiation, thus requiring that the quadrupole moment be quite small. The pulsar must also be rotating below the critical frequency at which its equilibrium configuration would become non-axisymmetric, since the lifetime of this configuration against decay by gravitational radiation is very short. This critical frequency, given by the theory of rotating ellipsoids, imposes a restriction on the rotation rate more severe than the break-up frequency and may be used to set a lower limit, rho 2 x 10 to the 14th power g/cu cm, on the density of the star. If the mass is 0.5 - 1.5 solar mass, several of the stiffer neutron star equations of state may be ruled out, and the radius should be less than 16 km. The condition for axisymmetry also imposes an upper limit on the rotation rate to which neutron stars may be spun up by accretion disks in binary systems, a model recently proposed for the evolution of the millisecond pulsar.

38667 (N—8329153) Structure and other properties of Jupiter's distant magnetotail. Lepping, R.P.; Desch, M.D.; Klein, L.W.; Sittler, E.C. Jr. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1983. 53p. (NASA-TM—85054). NTIS, PC A04/MF A01.

Analyses of data from Voyager 2 experiments provide evidence for, and characteristics of, a Jovian magnetotail extending at least to 9,000 Jovian radii from the planet. During approximately (25 day) periodic sightings of the tail, the magnetic field tended to point radially towards or away from Jupiter, indicating preservation to large distances of the bipolar, lobe like structure observed near the planet. This periodicity, along with various properties of the solar wind at this time, indicates that the tail is apparently influenced by recurrent solar wind features. Anomalous magnetic fields, not aligned with the nominal tail axis, also exist within the tail, especially in the low density, central (core) region, indicating some complexity of internal structure.

38668 (N—8329154) An analysis of the structure of Saturn's magnetic field using charged particle absorption signatures. Chenette, D.L.; Davis, L. Jr. (Aerospace Corp., El Segundo, CA (USA)). Jun 1983. 34p. (ATR—83(9558)-2). NTIS, PC A03/MF A01.

A technique is derived for determining the structure of Saturn's magnetic field. This technique uses the observed positions of charged particle absorption signatures due to the satellites and rings of Saturn to determine the parameters of an axially symmetric, spherical harmonic model of the magnetic field using the method of least squares. Absorption signatures observed along the Pioneer 11, Voyager 1, and Voyager 2 spacecraft trajectories are used to derive values for the orientation of the magnetic symmetry axis relative to Saturn's axis of rotation, the axial displacement of the center of the magnetic dipole from the center of Saturn, and the magnitude of the external field component. A comparison of these results with the magnetic field model parameters deduced from analyses of magnetometer data supports models which incorporate a northward offset of the dipole center by about 0.05 R(3).

38669 (N—8329155) Observational constraints on the atmospheres of Uranus and Neptune from new measurements near 10 micron. Orton, G.S.; Tokunaga, A.T. (Jet Propulsion Lab., Pasadena, CA (USA)). 1982. 46p. (NASA-CR—172703). NTIS, PC A03/MF A01.

Uranus was detected at 10.3, 11.6 and 12.5 micrometers approximately 1 micrometer spectral bandpasses, with respective brightness temperatures of 74.0 + 0.9 or -1.1, 67.6 + 0.5 or -0.7, and 65.5 + 0.6 or -0.7 K and the first detection of Neptune at 10.3 micrometers with a brightness temperature of 77.5 + 0.7 or -0.9 K. We also detected Neptune at 11.36 micrometers with 2% spectral resolution at 81.0 + 0.8 or -0.9 K. The 10 micrometers continuous of both Uranus and Neptune may in part be due to reflected solar radiation as well as thermal emission. If all of the observed flux is reflected light, then the maximum geometric albedo of Uranus is 0.115 + or - 0.020, and that of Neptune is 0.229 + or - 0.043. In the context of previous observations in this region, the maximum stratospheric C2H6 mixing ratio is found to be 3 x 10 to the -8 power for Uranus and 3 x 10 to the -6 power for Neptune. A value for the maximum mixing ratio in the stratosphere of Neptune on the order of 1 - 0.004 appears to be consistent with the available data.

38670 (N—8329157) Observations of the 10 micrometer natural laser emission from the mesospheres of Mars and Venus. Deming, D.; Espenak, F.; Jennings, D.; Kostiuk, T.; Mumma, M.J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1983. 26p. (NASA-TM—85044). NTIS, PC A03/MF A01.

Observations of the total flux and center to limb dependence of the nonthermal emission occurring in the cores of the 9.4 and

10.4 micrometers CO2 bands on Mars are compared to a theoretical model based on this mechanism. The model successfully reproduces the observed center to limb dependence of this emission, to within the limits imposed by the spatial resolution of the observations of Mars and Venus. The observed flux from Mars agrees closely with the prediction of the model the flux observed from Venus is 74% of the flux predicted by the model. This emission is used to obtain the kinetic temperatures of the Martian and Venusian mesospheres. For Mars near 70 km altitude, a rotational temperature analysis using five lines gives T 135 + or - 20 K. The frequency width of the emission is also analyzed to derive a temperature of 126 + or - 6 K. In the case of the Venusian mesosphere near 109 km, the frequency width of the emission gives T 204 + or - 10 K.

38671 **(N—8329158) Composition and sources of heavy ions in the outer Kronian magnetosphere.** Eviatar, A.; Siscoe, G.L.; Mcnutt, R.L.; Sullivan, J.D. (Massachusetts Inst. of Tech., Cambridge (USA)). 1982. 30p. (CSR-P—82-4). NTIS, PC A03/MF A01.

The Voyager 1 Plasma Science (PLS) experiment observed heavy ions near the equatorial plane of Saturn. The plasma density, as masured by the electrons, increased precipitously at L 18 on both the inbound and outbound passes and continued to increase rapidly into the boundary of the inner plasma region. The ion plasma contains both cold and dense material along with hot and more tenuous matter. The sources and sinks for this material which exist in the outer magnetosphere of Saturn and their implications for the composition of the heavy ion plasma are discussed.

38672 **(N—8329162) The acceleration and propagation of solar flare energetic particles.** Forman, M.A.; Ramaty, R.; Zweibel, E.G. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Aug 1982. 85p. (NASA-TM—83989). NTIS, PC A05/MF A01.

Repr. from The Physics of the Sun, Chapter 11.

Observations and theories of particle acceleration in solar flares are reviewed. The most direct signatures of particle acceleration in flares are gamma rays, X-rays and radio emissions produced by the energetic particles in the solar atmosphere and energetic particles detected in interplanetary space and in the Earth's atmosphere. The implication of these observations are discussed. Stochastic and shock acceleration as well as acceleration in direct electric fields are considered. Interplanetary particle propagation is discussed and an overview of the highlights of both current and promising future research is presented.

38673 **(N—8330336) Io escape and ionization of atmospheric gases.** Smyth, W.H. (Atmospheric and Environmental Research, Inc., Cambridge, MA (USA)). Apr 1983. 40p. (NASA-CR—172885). NTIS, PC A03/MF A01.

Exploratory model calculations for the Io atomic oxygen cloud have provided two-dimensional sky-plane intensities for the 6300 A, 1304 A and 880 A lines, where volume excitation and ionization rates are determined by impact collisions with Io plasma torus electrons. Comparison of model results with observations at 6300 A suggests an isotropic oxygen flux from Io of about 1.5x109 atoms 1 sq cm/sec. The effects of including a neutral sulfur cloud and also of including charge exchange reactions between plasma torus ions and neutral OI and SI were evaluated to be significant and were roughly estimated to increase the required oxygen flux to 1.2 x 10 to the 10th atoms/sq cm/sec. In addition, increases in the estimates for the ion loading, cloud mass loss, plasma mass loading and ion energy input rates were also made. Model calculations for an Io sulfur cloud, excluding charge exchange reactions but assuming an SI flux of 7.5 x 10 to the 8th atoms/sq cm/sec (i.e., half of the oxygen flux), were also performed and provided sky plane intensities for a number of visible and IR emission lines.

38674 **(N—8330344) Infrared molecular emissions from comets.** Weaver, H.A.; Mumma, M.J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jul 1983. 67p. (NASA-TM—85067). NTIS, PC A04/MF A01.

The possibility of detecting IR molecular line emission from cometary parent molecules is explored. Due to the non-LTE conditions in the inner coma and the large amount of near IR solar flux, IR fluorescence will be a significant source of cometary emission and, in fact, will dominate the grain radiation in a sufficiently high resolution instrument. The detection of this line emission will be difficult due to absorption in the terrestrial atmosphere, but it appears possible to measure cometary H2O emission from airplane altitudes. As IR molecular line emission represents one of the few promising methods of detecting cometary parent molecules directly, further research on this problem should be vigorously pursued.

38675 **(N—8330345) Currents in Saturn's magnetosphere.** Connerney, J.E.; Acuna, M.H.; Ness, N.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1983. 46p. (NASA-TM—85055). NTIS, PC A03/MF A01.

A model of Saturn's magnetospheric magnetic field is obtained from the Voyager 1 and 2 observations. A representation consisting of the Z sub 3 zonal harmonic model of Saturn's planetary magnetic field together with an explicit model of Saturn's planetary magnetic field and a model of the equatorial ring current fits the observations well within r 20 R sub S, with the exception of data obtained during the Voyager 2 inbound pass.

38676 **(N—8330346) Structure and dynamics of Saturn's outer magnetosphere and boundary regions.** Behannon, K.W.; Lepping, R.P.; Ness, N.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 35p. (NASA-TM—85065). NTIS, PC A03/MF A01.

In 1979-1981, the three USA spacecraft Pioneer 11 and Voyagers 1 and 2 discovered and explored the magnetosphere of Saturn to the limited extent possible on flyby trajectories. Considerable variation in the locations of the bow shock (BS) and magnetopause (MP) surfaces were observed in association with variable solar wind conditions and, during the Voyager 2 encounter, possible immersion in Jupiter's distant magnetic tail. The limited number of BS and MP crossings were concentrated near the subsolar region and the dawn terminator, and that fact, together with the temporal variability, makes it difficult to assess the three dimensional shape of the sunward magnetospheric boundary. The combined BS and MP crossing positions from the three spacecraft yield an average BS-to-MP stagnation point distance ratio of 1.29 +/- 0.10. This is near the 1.33 value for the Earth's magnetosphere, implying a similar sunward shape at Saturn. Study of the structure and dynamical behavior of the outer magnetosphere, both in the sunward hemisphere and the magnetotail region using combined plasma and magnetic field data, suggest that Saturn's magnetosphere is more similar to that of Earth than that of Jupiter.

38677 **(N—8330350) A study of the temporal and spectral characteristics of gamma ray bursts.** Norris, J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 279p. (NASA-TM—85031). NTIS, PC A13/MF A01.

Gamma-ray burst data obtained from the ISEE-3 Gamma Ray Burst Spectrometer and the Solar Maximum Mission's Hard X-ray Burst Spectrometer (HXRBS) were analyzed to yield information on burst temporal and spectral characteristics. A Monte Carlo approach was used to simulate the HXRBS response to candidate spectral models. At energies above about 100 keV, the spectra are well fit by exponential forms. At lower energies, 30 keV to 60 keV, depressions below the model continua are apparent in some bursts. The depressions are not instrumental or data-reduction artifacts. The event selection criterion of the ISEE-3 experiment is based on the time to accumulate a present number of photons rather than the photon count per unit time and is consequently independent of event duration for a given burst intensity, unlike most conventional systems. As a result, a significantly greater percentage of fast, narrow events have been detected. The ratio of count rates from two ISEE-3 detectors indicates that bursts with durations or aprox. one second have much softer spectra than longer bursts.

38678 (N—8330351) High Energy Astrophysics Laboratory Contributions to the 18th International Cosmic Ray Conference. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1983. 53p. (NASA-TM—85034; CONF-830830—). NTIS, PC A04/MF A01.

From 18. international cosmic ray conference; Bangalore, India (22 Aug 1983).

Gamma ray astrophysics, cosmic rays, solar modulation, solar particles, and instrumentation are addressed.

38679 (PB—84-188671) Solar-geophysical data number 474, February 1984. Part 2 (comprehensive reports). Data for August 1983, April 1981 and miscellanea. Coffey, H.E. (National Geophysical Data Center, Boulder, CO (USA)). Feb 1984. 96p. (SGD—474-PT-2). NTIS, PC A05/MF A01.

See also PB84-188689 and PB84-162692.

Contents: Detailed Index for 1983/1984; Data for August 1983 -- (Solar Radio Bursts at Fixed Frequencies, Mass Ejections from the Sun); Data for April 1981 -- Solar Flares.

38680 Energy spectrum of 35- to 1600-keV protons associated with interplanetary shocks. van Nes, P.; Reinhard, R.; Sanderson, T.R.; Wenzel, K.; Zwickl, R.D. (Space Science Department of the European Space Agency European Space Research and Technology Centre). *Journal of Geophysical Research;* **89**: No. A4, 2122-2132(1 Apr 1984).

We present the results of a statistical study on the proton energy spectra in the range of 35—1600 keV during the one-hour interval centered on the time of arrival of the shock front at the spacecraft of 75 interplanetary shocks that cover the period from August 1978 until December 1980, using the low-energy proton experiment on ISEE 3. The strength of the shocks was determined by calculating the ratio of the downstream to upstream plasma density by using the ion data obtained by the Los Alamos solar wind instrument. The shock events were sub-divided into four different classes based on the behavior of their low-energy (35—238 keV) spectral index. The signatures of the shock events and their spectral index-time profiles in the different classes are (1) smooth profiles associated with oblique, strong, and fast shocks, which roughly corresponds with predictions following from diffusive shock acceleration theory: (2) irregular profiles mainly associated with quasi-perpendicular shocks and (3) spikelike profiles associated with quasi-perpendicular shock spike events, where the properties within both classes point at predominant shock drift acceleration: (4) flat profiles, mainly associated with weak shocks accompanied by little or no shock-accelerated particles. Strong and fast oblique shocks are found to be the most effective particle accelerator. The spectrum at the shock can generally be described by two power laws with a breakpoint energy near 250 keV. For only 15% of the events the spectrum followed a power law over the full energy range.

38681 Polarized radiation from hot plasmas and applications to AM herculis binaries. II. Effect of collisions and thomson scattering. Barrett, P.E.; Chanmugam, G. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge; and Los Alamos National Laboratory). *Astrophysical Journal;* **278**: No. 1, 298-309(1 Mar 1984).

The absorption coefficients in the ordinary and extraordinary modes are calculated, for radiation emitted by magnetoactive plasmas with temperatures in the range 0.1—5 keV. The equations of radiative transfer for a homogeneous plasma, with large Faraday rotation, are solved, and simple analytic expressions for the Stokes parameters Q and V are derived in terms of the optical depths in the ordinary and extraordinary modes. The results are applied to homogeneous plasma slabs which represent a simple model for the accretion columns of the AM Herculis binaries. It is shown that the inclusion of the effects of collisions and Thomson scattering reduces the amount of fractional polarized radiation, bringing better agreement with observations. For small viewing angles with the magnetic field the circular polarization does not approach 100% as in the collisionless case, but instead approaches 0% or a value less than 100% depending on the geometry. This may provide a qualitative explanation for the standstills observed in some AM Her binaries.

38682 Spacetime thermodynamics and the inflationary universe. Kephart, T.W.; Ng, Y.J.; van Dam, H. (Department of Physics and Astronomy, University of North Carolina, Chapel Hill). *Astrophysical Journal;* **277**: No. 2, 478-480(15 Feb 1984). Contract AS05-79ER10448.

Following Sakharov, we liken spacetime to an elastic medium with the gravitational constant G playing the role of a temperature-dependent elastic constant. Within this approximation scheme, if G is a decreasing function of temperature, then the flatness and horizon problems are less severe but cannot be solved completely. Hence it appears that some type of inflationary scenario is unavoidable if these fine tuning problems are to be solved without fundamental modifications of the Einstein equations.

38683 The imaging compton telescope COMPTEL on the gamma ray observatory. Schonfelder, V.; Aarts, H.; Deerenberg, A.J.M.; Diehl, R.; Lichti, G.G.; Lockwood, J.; Steinle, H.; Swanburg, B.N. (Max Planck Institut fur Extraterrestriche Physik, 8046 garching, B.). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 766-770(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

This instrument is based on a newly established concept of γ-ray detection in the very difficult 1-30 MeV range. It employs the unique feature of a two-step interaction of the γ-ray: a Compton scattering collision in a first detector followed by an interaction in a second detector element. COMPTEL has been designed to perform a very sensitive survey of the γ-ray sky. Extreme care has been taken to minimize background so that the detection limits of COMPTEL will be dominated by source counting statistics. It combines a wide field of view (about 1 steradian) with a good angular resolution. The design criteria of COMPTEL and the performance of a Science Model are described.

38684 Effect of strain-rate dependent yield strength on crater scaling relations. Gaffney, E.S. (Los Alamos National Laboratory, Low Alamos, New Mexico 87545). *Geophysical Research Letters;* **11**: No. 2, 121-123(Feb 1984).

For materials whose strength is controlled by various creep processes, such as ice, the yield strength (Y) is often expressed in a power law relation to the strain rate (ϵ); Yproportionalepsilon-dot/ sup I/n/, where n is a constant for some range of epsilon-dot. It has been shown that, for strength-dominated craters, the crater formation time is proportional to the crater radius R and to $\sqrt{Y}$. But the strain associated with crater formation is approximately fixed in the strength regime so the strain rate controlling crater formation will vary as $\sqrt{YR}$. The result of combining these two effects is that, in materials with strain-rate dependent yield strengths, there will be a small increse in cratering efficiency (mass of ejecta/mass of explosive or impactor) as size increases in the strength-dominated regime. Explosive cratering data indicate that $1.6<n<3.0$ for centimeter- to meter-scale craters. Use of conventional crater scaling relations will, therefore, underestimate the size of crater produced by an explosion in or impact into ice. Thus, ages inferred for surfaces on icy satellites may be too large.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 64020038372, 38374, 38973

38685 (AD-A—140173/6) Energetic ion beam-plasma interactions. Final report 15 Jun 83-15 Jan 84. Kulsrud, R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). 9 Mar 1984. 7p. NTIS, PC A02/MF A01.

Continuation of Grant AFOSR-81-0106.

This final report covers work carried out under a Air Force Office of Scientific Research Grant during the period June 15, 1983 to January 15, 1984. During this concluding period we completed the investigation of the amount of neutralization of the energetic ion beam and carried out preliminary investigations of possible instabilities and of the rate at which the beam might expand under various conditions.

38686 **(CSIR-S—325) Papers presented at the symposium on upper atmosphere research in South Africa August 4, 1982.** (Council for Scientific and Industrial Research, Hermanus (South Africa). Magnetic Observatory). 1982. 124p. (CONF-8208186—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780441.

From Symposium on upper atmosphere research in South Africa; Hermanus, South Africa (4 Aug 1982).

Abstracts of individual items from the symposium were prepared separately for the data base. (GHT)

38687 **(INPE—2260) Simulation of equatorial plasma bubble signatures on the OI 6300A nightglow meridional profile over Brazilian low latitude.** Nakamura, Y.; Sobral, J.H.A.; Abdu, M.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Nov 1981. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702565.

A quantitative interpretation of the meridional propagation of the airglow disturbance for events that have their onsets well westward of the photometer observing longitude, representing the post growth phase of a bubble, is attempted by carrying out a numerical simulation of the phenomenon. Airglow intensity as a function of zenith angle in the photometer scanning range was calculated using electron density profiles perturbed by field aligned plasma bubble whose vertical velocity and electron density depletion profile were determined from a numerical simulation of the nonlinear Rayleigh-Taylor instability under ionospheric conditions that best represented those of the observing period and location.

38688 **(N—8330095) Proceedings of the 1st Space Plasma Computer Analysis Network (SCAN) Workshop.** Green, J.L.; Waite, J.H.; Johnson, J.F.E. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Apr 1983. 33p. (NASA-TM—82514). NTIS, PC A03/MF A01.

The purpose of the workshop was to identify specific cooperative scientific study topics within the discipline of Ionosphere Magnetosphere Coupling processes and to develop methods and procedures to accomplish this cooperative research using SCAN facilities. Cooperative scientific research was initiated in the areas of polar cusp composition, O+ polar outflow, and magnetospheric boundary morphology studies and an approach using a common metafile structure was adopted to facilitate the exchange of data and plots between the various workshop participants. The advantages of in person versus remote workshops were discussed also.

38689 **Wave-particle transport from density drift instabilities: A comparison of local and nonlocal theories.** Bernhardt, P.A. (Los Alamos National Laboratory). *Journal of Geophysical Research;* **89**: No. A5, 2936-2944(1 May 1984).

A plasma density gradient perpendicular to an ambient magnetic field is unstable to the growth of electrostatic waves. The objective of this paper is to describe the rate at which these density drift instabilities transport plasma across the magnetic field lines. This objective is accomplished as follows: The plasma density irregularity is represented as a Fourier series. Using linear Vlasov theory, the nonlocal dispersion equation is derived, relating the Fourier amplitudes to the eigenvalues (i.e., wave frequencies and growth rates) for the electrostatic fluctuations. For each complex eigenvalue, an electrostatic eigenmode is computed. These eigenmodes grow to saturation and are summed, yielding the total electrostatic turbulence. The flux of the plasma across the magnetic field lines is computed from the turbulence. The transport derived from the nonlocal theory is compared with that derived by using the less complicated local approximation. Wave-particle transport based on the local approximation is shown to be valid only in regions where variations in the density gradient are small.

38690 **Low-altitude image striations associated with bottomside equatorial spread F: Observations and theory.** Vickrey, J.F.; Kelley, M.C.; Pfaff, R.; Goldman, S.R. (SRI International Radio Physics Laboratory). *Journal of Geophysical Research;* **89**: No. A5, 2955-2962(1 May 1984).

Ionspheric plasma instabilities are usually discussed in terms of local parameters. However, because electric fields of scale size $\lambda >$ or ≈ 1 km map along magnetic field lines, plasma populations far away from a locally unstable region may be affected by the instability process and vice versa. We present observations of electron density variations in the F_1 region of the ionosphere at two locations near the magnetic equator. Oscillations in electron number density that were confined to a narrow wavelength regime were observed in a region of the ionosphere with a very weak vertical density gradient. Since magnetic flux tube interchange instabilities cannot create structure in such an environment we suggest that these are "images" of instabilities occurring elsewhere along the magnetic field line. A simple steady state theory of image formation is developed that is in good agreement with the observations. Moreover, this theory predicts a scale size dependent "effective diffusion" process in the F region that may dominate over classical cross-field diffusion at kilometer scale sizes. Such a scale size dependent diffusion process is required to explain recent scintillation observations of decaying equatorial plumes.

38691 **Collisionless dissipation in quasi-perpendicular shocks.** Forslund, D.W.; Quest, K.B.; Brackbill, J.U.; Lee, K. (Los Alamos National Laboratory). *Journal of Geophysical Research;* **89**: No. A4, 2142-2150(1 Apr 1984).

Microscopic dissipation processes in quasi-perpendicular shocks are studied by two-dimensional plasma simulations in which electrons and ions are treated as particles moving in self-consistent electric magnetic fields. Cross-field currents induced substantial turbulence at the shock front reducing the reflected ion fraction, increasing the bulk ion temperature behind the shock, doubling the average magnetic ramp thickness, and enhancing the upstream field aligned electron heat flow. The short scale length magnetic fluctuations observed in the bow shock are probably associated with this turbulence.

38692 **Production of ion conics by oblique double layers.** Borovsky, J.E. (Los Alamos National Laboratory). *Journal of Geophysical Research;* **89**: No. A4, 2251-2266(1 Apr 1984).

Magnetized test ions are subjected to acceleration through a numerically simulated oblique double layer in order to determine whether they emerge with velocity vectors aligned with or oblique to the ambient magnetic field. A criterion for oblique alignment, depending on the double-layer parameters and on the external magnetization, is obtained. When it is applied to observed and theoretical auroral double layers, this criterion predicts that accelerated heavy ions will be substantially less magnetic field aligned than will accelerated hydrogen ions, thus suggesting auroral double layers as a source of high-energy ion conics. Test particle simulations are also used to investigate the perpendicular heating of ions at low altitudes by the electric fields associated with moving auroral arcs. The rapid motion of small-scale structures in the arces is suggested as a source of low-energy conical ion distributions, and the slow drifts of the entire arc forms are inferred to heat ionospheric ions.

38693 **Kinky heliospheric current sheet: Cause of CDAW-6 substorms.** Tsurutani, B.T.; Russell, C.T.; King, J.H.; Zwickl, R.D.; Lin, R.P. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109). *Geophysical Research Letters;* **11**: No. 4, 339-342(Apr 1984).

Two magnetospheric substorms and the intensification of the second are caused by interplanetary magnetic field and ram pressure changes associated with a kinky heliospheric current sheet (KHCS). The responsible interplanetary features occur in a highly compressed region between a solar flare-associated shock wave and the cold driver gas. The possibity that the interplanetary structure is a "magnetic cloud" is ruled out.

38694 **Observational evidence on the origin of ions upstream of the earth's bow shock.** Thomsen, M.F.; Schwartz, S.J.; Gosling, J.T. (Los Alamos National Lab., NM). *Journal of Geophysical Research;* **88**: No. A10, 7843-7852(1 Oct 1983).

The energies predicted by four different source hypotheses for ions observed upstream of the earth's bow shock are compared with observations of upstream field-aligned beams and gyrating ion events. A kinematic formalism in a frame of reference in which the motional electric field vanishes is used. Specular reflection of a fraction of the incident solar wind is found to be the most credible

explanation of gyrating ion events observed upstream of shocks ranging from quasi-parallel to nearly perpendicular. The recent hypothesis that field-aligned beams are the result of leakage from the magnetosheath of ions which were originally specularly reflected at quasi-perpendicular portions of the shock provides good agreement with observed energies of many field-aligned beams. Of the several source hypotheses examined, only magnetic moment conserving reflection of solar wind ions is capable of accounting for two very energetic beam events. Although the magnetic moment of an ion should not be conserved during a single encounter with the shock, it is possible that multiple encounters of ions which are originally specularly reflected at the shock can produce an upstream distribution of particles which appear to have conserved their magnetic moment. 6 figures.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 64030038048, 38049, 38059, 38229

38695 **(ANL—82-65-Pt.1) Fundamental molecular physics and chemistry. Radiological and Environmental Research Division annual report, October 1981-December 1982. Pt. 1.** (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 111p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84009127.

This document is the twelfth Annual Report of our Fundamental Molecular Physics and Chemistry Program. Scientifically, the work of the program deals with aspects of the physics and chemistry of molecules related to their interactions with photons, electrons, and other external agents. We chose these areas of study in view of our matic goals; that is to say, we chose them so that the eventual outcome of our work meets some of the needs of the US Department of Energy (DOE) and of other government agencies that support our research. First, we endeavor to determine theoretically and experimentally cross sections for electron and photon interactions with molecules, because those cross sections are indispensable for detailed microscopic analyses of the earliest processes of radiation action on any molecular substance, including biological materials. Those analyses in turn provide a sound basis for radiology and radiation dosimetry. Second, we study the spectroscopy of certain molecules and of small clusters of molecules because this topic is fundamental to the full understanding of atmospheric-pollutant chemistry.

38696 (DL/SCI/R—20, pp 16-20) **Ultrasoft x-ray resonance emission bands of lanthanide and actinide compounds.** Zimkina, T.M.; Shulakov, A.S.; Braiks, A.P. (Leningradskij Gosudarstvennyj Univ. (USSR)). 1984. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780531. (CONF-8211147—Exc.).

From Daresbury study on application of synchrotron radiation to problems in materials science; Daresbury, UK (13 Nov 1982).

A study is reported of the ultrasoft emission spectra of some lanthanide and actinide compounds at a low accelerating voltage in the X-ray tube: a strong and wide emission band was observed in the region of the giant resonance. The following results are shown: the lanthanum emission spectra in La_2O_3 obtained at accelerating voltages of 4, 1.5 and 0.5 KV and the absorption spectrum at the 4d threshold; similar measurements for Th in ThO_2 (and absorption spectrum at the 5d threshold) and U in U_3O_8 (and absorption spectrum at the 5d threshold); and for Ce in CeO_2 (and absorption spectrum at the 4d threshold). The results are discussed.

38697 **(DOE/ER/06027—14) Experimental studies of atomic inner shell ionization phenomena. Progress report V, 1 August 1983-1 July 1984.** Shafroth, S.M. (North Carolina Univ., Chapel Hill (USA)). 1984. Contract AS05-78ER06027. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013448.

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Since last year's progress report (August 1984), we have analyzed most of the data taken up to that time. This has revealed some problems and led to repeating the Si^{11+} on He and Ar experiments over a wider energy range. In the case of the He data four points in the RTE region were taken at Brookhaven by M. Clark, J. Tanis and collaborators, with a different Si(Li) detector. This will serve as a good check on the absolute cross sections at TUNL compared to those measured at Brookhaven.

38698 **(DOE/PC/50800—T5) Transport and relaxation processes in supercritical fluids. Technical progress report, January 1-December 31, 1983.** Jonas, J. (Illinois Univ., Urbana (USA)). 1984. Contract FG22-82PC50800. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006591.

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Work has continued according to the initial research plans in three main areas: (1) instrumentation for solubility measurements of solids in supercritical fluids; (2) transport in supercritical fluids; and (3) laser Raman scattering studies of collision induced scattering. These experiments yield direct information about intermolecular forces. This report includes theoretical interpretation of the experimental data on diffusion in supercritical ethylene, and progress reports for the following: (1) testing and revision of NMR probe for solubility measurements; (2) installation and testing of high pressure densitometer for supercritical fluids; and (3) collision induced scattering in supercritical sulfur hexafluoride. 5 figures.

38699 (INIS-mf—8921, pp 44) **Optogalvanic spectroscopy of quasi-resonant Penning ionization.** Shuker, R.; Ben-Amar, A.; Erez, G. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

38700 (INIS-mf—8921, pp 33) **Diffusion on fractals and on percolation clusters.** Havlin, S.; Ben-Avraham, D. (Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Physics). 1983. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780235. (CONF-8303128—Summ.).

From Israel Physical Society annual meeting; Ramat-Gan, Israel (24 Mar 1983).

38701 **(INIS-mf—8971) Screening effect of the projectile electrons of inner shell excitation.** Vegh, L.; Sarkadi, L. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780473.

The screening effect of the projectile electrons in cases of 1s-2p excitation and L-shell ionization is investigated in the framework of the semiclassical approximation. This approach allows to take into consideration the change of the screening with the impact parameter and with the position of the projectile along his path. The dependence of the screening effect on the projectile energy and ionic charge is discussed.

38702 (INIS-mf—9006, pp 106-115) **Investigation of mechanisms of charge transfer reactions using the crossed beams method.** Du Wen Hu (Northwestern Univ., Xian (China)); Bretislav, F. (Czechoslovak Academy of Sciences (Czechoslovakia)); Rockwood, A.; Howard, S.; Futrell, J.H. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry); Lindinger, W. (Innsbruck Univ. (Austria)). 1984. NTIS (US Sales Only), PC A18/MF A01. Order Number DE84780511. (CONF-840120—).

From 4. symposium on atomic and surface physics; Hintermoos, Austria (29 Jan 1984).

The crossed molecular beam method was used to investigate the state-to-state reaction dynamics of charge transfer in atomic ion-atom, atomic ion-diatomic molecule, and diatomic ion-diatomic molecule systems. The measurement of angular scattering along with translational energy exchange in these systems provides detailed information on both energy transfer and mechanisms of charge transfer reactions. The systems investigated (ran gases and simple diatomics) provide examples of symmetric resonnance, vibrational state-specific charge and energy transfer, extensive energy

mixing, direct and orbiting complex mechanisms, depending upon the collision partners and collision energies. (Author).

38703 (INIS-mf—9006, pp 144-154) **Transverse ion diffusion studied with the radial ion distribution method.** Maerk, T.D.; Girstmair, P.; Hesche, M.; Maerk, E. (Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik); Sejkora, G. (Innsbruck Univ., Dornbirn (Austria). Inst. fuer Textilchemie und -physik); Bryant, H.C. (New Mexico Univ., Albuquerque (USA). Dept. of Physics and Astronomy). 1984. NTIS (US Sales Only), PC A18/MF A01. Order Number DE84780511. (CONF-840120—).

From 4. symposium on atomic and surface physics; Hintermoos, Austria (29 Jan 1984).

A new apparatus (radial ion distribution method) for the quantitative study of the transverse diffusion of mass identified ions is presented. Measurements, recently completed and in progress, of the transverse diffusion of He^+ in He, Ne^+ and Ne^{2+} in Ne, Ar^+ and Ar^{2+} in Ar, N_2^+ and $(N_2)_2^+$ in N_2 are reported and theoretical implications of the results will be discussed.

38704 **(INIS-mf—9006) SASP '84: symposium on atomic and surface physics. Contributions.** Howorka, F.; Lindinger, W.; Maerk, T.D. (eds.). (Innsbruck Univ. (Austria). Inst. fuer Atomphysik). 1984. 420p. (CONF-840120—). NTIS (US Sales Only), PC A18/MF A01. Order Number DE84780511.

From 4. symposium on atomic and surface physics; Hintermoos, Austria (29 Jan 1984).

Abstracts of individual items from the symposium were prepared separately for the data base. (GHT)

38705 (INIS-SU—236, pp 47-51) **Radiation spectra of 1,2 GeV electrons in silicon and diamond monocrystals in motion along crystallographic axes and planes.** Ganenko, V.B.; Nasonov, N.N.; Pegushin, E.V.; Sanin, V.M.; Truten', V.I.; Fomin, S.P.; Shalatskij, S.V.; Shul'ga, N.F.; Miroshnichenko, I.I. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Measurements have been made of the absolute cross sections for the radiation of 1.2 GeV electrons moving along the crystallographic < 110 > axis and (001) plane of silicon and diamond single crystals. The experimental data agree with the theoretical calculations taking into consideration the contribution in radiation only above-barrier particles.

38706 **(INIS-SU—238) Study of conversion related to the effects of chemical environment of an atom.** Grechukhin, D.P.; Soldatov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 64p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780472.

A study of a number of problems related to the development of conversion method and interpretation of conversion spectra observed is continued. Effects imitating the conversion process on hybrid orbits are estimated, and it is shown that these effects are small. Characteristics of processes of conversion and photoionization of atoms are compared. The field of E-1 conversion integral and E3-nucleus multipoles set is investigated and the electron wave functions behaviour in this field is considered, which is a base for interpretation of the conversion spectra. Possible rate variation scales of the conversion process in case of configuration variation of valent zone of uranium, niobium and technetium atoms are estimated. Data on the electron shell structure extracted from conversion spectra are compared with information obtained by other methods of investigation of atoms.

38707 **(N—8330172) Photoionization research on atomic radiation. 3: The ionization cross section of atomic nitrogen.** Comes, F.J.; Elzer, A. (National Aeronautics and Space Administration, Washington, DC (USA)). Aug 1982. 10p. (NASA-TM—77107). NTIS, PC A02/MF A01.

Transl. from Z. fuer Naturforschung, Augsgabe A (USSR), v. 23a, No. 1, Jan 1968, p 133-136.

The photoionization cross section of atomic nitrogen was measured between the ionization limit and 432 A. The experimental values are well fitted by those from a calculation of HENRY due to the dipole velocity approximation. A Rydberg series converging to the 5S-state of the ion is clearly identified from the ionization measurements and is shown to ionize.

38708 **(N—8330173) Photoionization research on atomic beams. 2: The photoionization cross section of atomic oxygen.** Comes, F.J.; Speier, F.; Elzer, A. (National Aeronautics and Space Administration, Washington, DC (USA)). Aug 1982. 20p. (NASA-TM—77106). NTIS, PC A02/MF A01.

Transl. from Z. Naturforsch., A (West Germany), v. 23a, No. 1, Jan 1968, p 125-133; Original language document announced as A68-20280; Original document prepared by Bonn Univ., Physical Chemistry Inst., West Germany.

An experiment to determine the absolute value of the photoionization cross section of atomic oxygen is described. The atoms are produced in an electrical discharge in oxygen gas with 1% hydrogen added. In order to prevent recombination a crossed beam technique is employed. The ions formed are detected by a time-of-flight mass spectrometer. The concentration of oxygen atoms in the beam is 57%. The measured photoionization cross section of atomic oxygen is compared with theoretical data. The results show the participation of autoionization processes in ionization. The cross section at the autoionizing levels detected is considerably higher than the absorption due to the unperturbed continuum. Except for wavelengths where autoionization occurs, the measured ionization cross section is in fair agreement with theory. This holds up to 550 A whereas for shorter wavelengths the theoretical values are much higher.

38709 **(UM-P—83/64) (e,2e) spectrum of argon.** Mitroy, J.; Amos, K.; Morrison, I. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702535.

The Plane Wave Impulse Approximation is used to analyse the experimental cross-section for the Argon (e,2e) reaction (using the non-coplanar symmetric geometry). A series of Configuration Interaction calculations for the structure of Ar I and Ar II are reported demonstrating that correlation effects have only a minor effect on the momentum distributions (which are well described by the Target Hartree-Fock Approximation). Fair agreement between the theoretical and experimental spectroscopic factors for the separation energy spectrum is obtained, and in particular the distribution of strength amongst the $3s^2\ 3p^4$ nd ^2S/sup e/ satellite states specified by the largest calculations is in better agreement with data than that obtained with simple structure models.

38710 **Measurements of the electric dipole polarizabilities of the alkali halide dimers.** Kremens, R.; Bederson, B.; Jaduszliwer, B.; Stockdale, J.; Tino, A. (Department of Physics, New York University, New York, New York 10003). *Journal of Chemical Physics;* **81**: No. 4, 1676-1681(15 Aug 1984).

We report the first measurements of the average electric dipole polarizabilities of five alkali halide dimers. A combined monomer-dimer molecular beam deflection pattern in an inhomogeneous electric field is subject to an appropriate computational analysis to extract the polarizabilities. A simple combination of bond and effective ionic models to estimate the polarizabilities gives reasonably good agreement with the measured values. The values are, in units of 10^{-24} cm^3, $(KF)_2$:25.3 +- 3.2; $(KCl)_2$:28.6 +- 3.0; $(RbCl)_2$:43.4 +- 4.2; $(CsCl)_2$:36.6 +- 5.0; $(CsF)_2$:21.2 +- 2.6.

38711 **Measurement of N^+b recombination rate vs electron temperature in a proton beam created plasma.** Fitaire, M.; Pointu, A.M.; Stathopoulos, D.; Vialle, M. (Groupe "Plasma d'Origine Nucleaire," Laboratoire de Physique des Gaz et des Plasmas, Universite Paris-Sud, 91405 Orsay Cedex, France). *Journal of Chemical Physics;* **81**: No. 4, 1753-1758(15 Aug 1984).

An experimental method for studying electron—ion recombination process is described. It uses RF pulse heating of a plasma created by a proton beam in high pressure Ne:N_2 mixture. The recombination coefficient of N^+_4 ion has been determined to be (2.3 +- 0.5)10^{-6} (T/sub e//300)/sup() -0.53plus-or-minus0.14/ cm^3 s^{-1} for electron temperature T/sub e/ between 2000 and 11 000 K.

38712 **Temperature dependence of thermal positive ion production from sodium bromide molecules incident upon a glowing rhenium surface.** Kawano, H.; Kenpo, T. (Department of Chemistry, Faculty of Science, Ehime University, 2-5, Bunkyo-cho, Matsuyama, 790, Japan). *Journal of Chemical Physics;* **81**: No. 3, 1248-1250(1 Aug 1984).

Emission current of Na^+ ions produced from NaBr molecules impinging with a flux of 6.55 x 10^{13} molecules cm^{-2} s^{-1} upon a heated polycrystalline rhenium surface in the residual gas pressure of about 2 x 10^{-7} Torr was measured as a function of surface temperature (T) in the range of about 900—2100 K, thereby indicating that the sticking probability of NaBr to the surface is virtually unity and that the ionization efficiency (β^+) is ~1 and 0.23 for T≅1100—1500 and 1800—2100 K, respectively. These results are explained reasonably by our previous theory that the degree (γ) of dissociation of incident molecules generally depends upon the ionization coefficient (α^+) and hence upon the effective work function (phi^+) for the positive ionization unless α^+ is much smaller than unity. The value of phi^+ was 5.45—5.51 eV for T> or ≅1800 K, below which phi^+ gradually increased up to ~6.8 eV according to a decrease in T. By this increase both β^+ and γ were kept at virtually unity even at a low temperature down to about 1100 K, at which they began to decrease sharply with a reduction in T because phi^+ had already turned to a decrease at about 1200 K.

38713 **Fermi atomic pseudopotential.** Cohen, M.L. (Department of Physics, University of California, and Materials and Molecular Research Divison, Lawrence Berkeley Laboratory, Berkeley, California 94720). *American Journal of Physics;* **52**: No. 8, 695-703(Aug 1984). Contract AC03-76SF00098.

A discussion of Fermi's calculation using the pseudopotential approach is given. This is followed by a brief review of some of the principal extensions and applications of atomic pseudopotentials to condensed matter physics in the following 50 years.

38714 **Electron production in collisions between light ions and rare gases: The importance of the charge-transfer and direct-ionization channels.** DuBois, R.B. (Pacific Northwest Laboratory, Richland, Washington 99352). *Physical Review Letters;* **52**: No. 26, 2348-2351(25 Jun 1984). Contract AC06-76RL01830.

Coincidence measurements were performed to separate the charge-transfer and direct-ionization channels for 15—100-keV, H^+,He^+ collisions with Ne,Ar,Kr. Absolute cross sections are given for the production of single and multiple ionization of the target by these two ionization mechanisms. It is demonstrated that as the collision system becomes heavier, the multiple ionization components of these two channels become increasingly more important, and the production of free electrons results primarily from higher-order charge-transfer channels: not from direct single target ionization.

38715 **Electronic shell structure and abundances of sodium clusters.** Knight, W.D.; Clemenger, K.; de Heer, W.A.; Saunders, W.A.; Chou, M.Y.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Clarendon Laboratory, Oxford OX1 3PU, United Kingdom). *Physical Review Letters;* **52**: No. 24, 2141-2143(11 Jun 1984). Contract AC03-76SF00098.

Mass spectra are presented for sodium clusters of N atoms per cluster (N = 4—100) produced in a supersonic expansion with argon carrier gas. The spectra show large peaks or steps at N = i, 20, 40, 58, and 92. These can be understood in terms of a one-electron shell model in which independent delocalized atomic 3s electrons are bound in a spherically symmetric potential well.

38716 **Measurements of inelastic collisions between Cs^+ ions by a plasma-target technique.** Stalder, K.R.; Berkner, K.H.; Pyle, R.V. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review [Section] A: General Physics;* **29**: No. 6, 3052-3059(Jun 1984). Contract AC03-76SF00098.

Cross sections for Cs^{2+} formation in $Cs^+ + Cs^+$ collisions have been measured by a plasma-target technique for center-of-mass energies from 50 to 110 keV. The measured cross sections for the sum of ionization and charge exchange are in moderate agreement with the results of Peart et al., and disagree with the results of Dunn et al. and of Neill et al. at the lower energies. The experimental technique and possible sources of error are discussed in light of the discrepancy between the results of the three groups.

38717 **Intercombination lines of Al VIII, Al IX, and Al X ions.** Denne, B.; Hinnov, E. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physical Review [Section] A: General Physics;* **29**: No. 6, 3442-3443(Jun 1984). Contract AC02-76CH03073.

Several aluminum lines observed in the Princeton Large Torus tokamak discharges have been identified as intersystem transitions, establishing the energies of the Al VIII $2s2p^3$ ^5S, Al IX $2s2p^2$ ^4P, and Al X 2s2p ^3P terms. Some observations of isoelectronic transitions in scandium and titanium ions are also reported.

38718 **Pre-Gaussian noise in strong laser-atom interactions.** Wodkiewicz, K.; Shore, B.W.; Eberly, J.H. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 3, 398-403(Jun 1984). Contract W-7405-ENG-48.

We present a continuation of a general theoretical approach to noisy laser-atom inteactions based on a special Markov-chain description of external fluctuations. This chain, composed of n independent two-state jump processes, forms a non-Gaussian stochastic process from which a detailed discussion of the atomic response can be given. We show that the n-component Markov chain also has the property of pre-Gaussian noise, because in the limit of $n \to \infty$ it converges to a Gaussian stochastic process. We exhibit solutions for the field spectrum and the atomic-fluorescence spectrum for phase, frequency, and amplitude pre-Gaussian fluctuations of the driving-laser light.

38719 **Simultaneous laser- and ion-beam excitation of a Na-beam target.** Schneider, D.; Pfeufer, V.; Stoeffler, W.; Bruch, R.; Berry, H.G.; Somerville, L.P.; Hardis, J.E.; Arcuni, P.; Seidel, P.; Moore, C.F. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **52**: No. 20, 1767-1770(14 May 1984). Contract W-31-109-ENG-38.

We report the first measurement of Na and Na^+ autoionization spectra following collisions of 1-MeV He^+ ions on selectively excited Na 3p ^{2}P/sub 3/2/ target atoms. The atomic states were populated with a c.w. dye laser which was tuned to the Na 3s ^{2}S/sub 1/2/→Na 3p ^{2}P/sub 3/2/ transition. The simultaneous laser-ion beam excitation technique produces significant intensity variations particularly for the decay of the Na^+ 2s2p ^{6}3s /sup 1,3/S and the Na^+ 2s2p ^{6}3p /sup 1,3/P states. The technique may provide additional information for line identification, excitation mechanisms, and angular distribution measurements.

38720 **3ν_3 overtone intensities and vibrational anharmonicity constants of UF_6 and PuF_6.** Kim, K.C.; Briesmeister, R.A.; Campbell, G.M.; Person, W.B. (Los Alamos National Lab., NM). *Chemical Physics Letters;* **104**: No. 1, 79-82(27 Jan 1984).

We report the 3ν_3 band contour analyses of UF_6 and PuF_6. The transition wavenumbers and the absolute vibrational intensities are determined, and systematics of the overtone intensities among SF_6, UF_6, and PuF_6 are discussed.

38721 **(ORNL-tr—5153) Measurement of scattering cross sections of liquid and solid hydrogen, deuterium and deuterium hydride for thermal neutrons.** Seiffert, W.D. (Oak Ridge National Lab., TN (USA); Commission of the European Communities, Brussels (Belgium)). 1984. Contract AC05-84OR21400. Translation source information not available . (EUR—4455). 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014814.

Portions are illegible in microfiche products; Thesis. Submitted to Technical Univ. of Munich, Germany.

The scattering cross sections for liquid and solid normal hydrogen, para-hydrogen, deuterium and deuterium hydride were measured for thermal neutrons at various temperatures. Solid samples of para-hydrogen exhibit distinct Bragg scattering. Liquid samples of deuterium and para-hydrogen also exhibit distinct coherence phenomena, which is indicative of strong local ordering of the molecules. In para-hydrogen and deuterium hydride, the threshold for scattering with excitation of rotations is distinctly visible. The positions of the thresholds show that the molecules in liquid hydrogen are not unhindered in their movement. After the beginning of the rotational excitation the scattering cross sections of liquid and solid para-hydrogen have different shapes which is to be explained by the differences in the dynamics of the liquid and the solid specimen. 22 references.

38722 **Magnetism in the actinides: the role of neutron scattering.** Lander, G.H. (Argonne National Lab., IL (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). pp 233-238 of Neutron and its applications, 1982. Plenary and invited papers from the conference to mark the 50th anniversary of the discovery of the neutron held at Cambridge, 13-17 September 1982. Schofield, P. (ed.). Bristol, England; Institute of Physics (1983). (CONF-820950—).

From Conference on the neutron and its applications; Cambridge, UK (13 Sep 1982).

Neutron scattering has played a crucial and unique role of elucidating the magnetism in actinide compounds. Examples are given of elastic scattering to determine magnetic structures, measure spatial correlations in the critical regime, and magnetic form factors, and of inelastic scattering to measure the (often elusive) spin excitations. Some future directions will be discussed.

38723 **Spectroscopy of multi-charged ions: a short review.** Berry, H.G. (Inst. of Physics, Lund Univ., Lund). *Nuclear Science Applications;* **1**: No. 6, 527-553(1983). Contract W-31-109-ENG-38.

Recent and future applications of multiply charged ions to spectroscopy and atomic structure are discussed. The experimental techniques use either very fast ions produced in heavy ion accelerators, or slow ions produced directly both in electron beam ion sources and from collisions of fast accelerated ions. For the accelerated fast ions, spectroscopic measurements on using gas target excitation, solid foil excitation and laser excitation. In gas target excitation, both X-ray and electron spectroscopy have been applied to analyse atomic structures and secondary collision effects. Highly-charged secondary ions have also been trapped electro-magnetically for further similar studies in controlled conditions. Spectroscopic detection following solid foil interaction has led to atomic lifetime measurements, principally of metastable level, analysis of complex highly-ionized heavy ion spectra, and investigations of relativistic and QED effects in few electron ions.

38724 **Body-fixed complex-coordinate coupled-channel formalism for rotational predissociation of van der Waals molecules.** Chu, S.I. (Univ. of Kansas, Lawrence). *Chemical Physics Letters;* **88**: No. 2, 213-219(30 Apr 1982). Contract AC02-80ER10748.

The method of complex-coordinate coupled-channel (CCCC) formalism previously developed in the space-fixed (SF) frame is reformulated in the body-fixed (BF) frame, more appropriate for strong-coupling van der Waals complexes. The utility of the method is demonstrated through a study of the level widths and energies of rotationally predissociating atom-diatom model systems. The possible usefulness of incorporating the centrifugal decoupling approximation in the BF CCCC theory is pointed out.

38725 **Complex scaling method for numerical potentials.** Datta, K.K.; Chu, S.I. (Univ. of Kansas, Lawrence). *Chemical Physics Letters;* **87**: No. 4, 357-364(2 Apr 1982). Contract AC02-80ER10748.

The method of complex scaling transformation can be extended to either numerical or sophisticated piecewise inhomogeneous potentials, incorporating the use of several well-established transformation theories and stable quadrature algorithms. The method is illustrated by a study of the multichannel rotational predissociations of Ar...N_2 van der Waals molecules, using tabulated numerical anisotropic potentials.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 64041038698

38726 **Poisson structure of the equations of ideal multispecies fluid electrodynamics.** Spencer, R.G. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Mathematical Physics (New York);* **25**: No. 8, 2390-2396(Aug 1984). Contract AC03-76SF00098.

The equations of the two- (or multi-) fluid model of plasma physics are recast in Hamiltonian form, following general methods of symplectic geometry. The dynamical variables are the fields of physical interest, but are noncanonical, so that the Poisson bracket in the theory is not the standard one. However, it is a skew-symmetric bilinear form which, from the method of derivation, automatically satisfies the Jacobi identity; therefore, this noncanonical structure has all the essential properties of a canonical Poisson bracket.

38727 **Richardson number criterion for the nonlinear stability of three-dimensional stratified flow.** Abarbanel, H.D.I.; Holm, D.D.; Marsden, J.E.; Ratiu, T. (Scripps Institution of Oceanography and Project in Nonlinear Science, University of California, San Diego, La Jolla, California 92093). *Physical Review Letters;* **52**: No. 26, 2352-2355(25 Jun 1984). Contract W-7405-ENG-36.

With use of a method of Arnol'd, we derive the necessary and sufficient conditions for the formal stability of a parallel shear flow in a three-dimensional stratified fluid. When the local Richardson number defined with respect to density variations is everywhere greater than unity, the equilibrium is formally stable under nonlinear perturbations. The essential physical content of the nonlinear stability result is that the total energy acts as a "potential well' for deformations of the fluid across constant density surfaces; this well is required to have definite curvature to assure stability under these deformations.

38728 **Entropy of He II from 1.6 K to the λ line.** Singsaas, A.; Ahlers, G. (Department of Physics, University of California, Santa Barbara, California 93106). *Physical Review [Section] B: Condensed Matter;* **29**: No. 9, 4951-4960(1 May 1984).

The fountain pressure of He II was measured and the results were used to obtain the entropy from 1.6 K to near T/sub lambda/ at vapor pressure and from 1.7 K to near T/sub lambda/ at various pressures up to 29 bar. The data have a precision of +- 0.1% and an accuracy of +- 0.5%. There is excellent agreement with recent calorimetric measurements at vapor pressure and good agreement within the combined error estimates with some, but not all, previous fountain-pressure measurements. The small quantity $\Delta S = \int$/ sub T/o/sup T//sub lambda/ (C/sub p//T)dT was added to our measurements near T/sub lambda/ to yield values for S/sub lambda/(P) which were fitted to an empirical equation with a scatter of +- 0.1%. The increased accuracy of our new measurements will reduce considerably the experimental errors in the determination of the superfluid fraction from the second-sound velocity near the superfluid transition line.

38729 Molecular dynamics calculations of the hard-sphere equation of state. Erpenbeck, J.J.; Wood, W.W. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **35**: No. 2, 321-442(May 1984).

The equation of state of the hard-sphere fluid is studied by a Monte Carlo-molecular dynamics method for volumes ranging from 25 V_0 to 1.6V_0, where V_0 is the close-packed volume, and for systems sizes from 108 to 4000 particles. The N dependence of the equation of state is compared to the theoretical dependence given by Salsburg for the NPT ensemble, after correction for the ensemble difference, in order to obtain estimates for the thermodynamic limit. The observed values of the pressure are compared with both the [3/2] and the [2/3] Pade approximants to the virial series, using Kratky's value for the fifth virial coefficient B_5 and choosing B_6 and B_7 to obtain a least-squares fit. The resulting values of B_8 and B_7 lie within the uncertainties of the Ree-Hoover-Kratky Monte Carlo estimates for these virial coefficients. The values of B_8, B_9, and B_{10} predicted by our optimal [3/2] approximant are also reported. Finally, the Monte Carlo-molecular dynamics equation of state is compared with a number of analytic number of analytic expressions for the hard-sphere equation of state.

38730 Numerical simulation of two-dimensional fluid flow with strong shocks. Woodward, P.; Colella, P. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Computational Physics;* **54**: No. 1, 115-173(Apr 1984). Contract W-7405-ENG-48.

Results of an extensive comparison of numerical methods for simulating hydrodynamics are presented and discussed. This study focuses on the simulation of fluid flows with strong shocks in two dimensions. By "strong shocks," we here refer to shocks in which there is substantial entropy production. For the case of shocks in air, we therefore refer to Mach numbers of three and greater. For flows containing such strong shocks we find that a careful treatment of flow discontinuities is of greatest importance in obtaining accurate numerical results. Three aproaches to treating discontinuities in the flow are discussed-artificial viscosity, blending of low- and high-order-accurate fluxes, and the use of nonlinear solutions to Riemann's problem. The advantages and disadvantages of each approach are discussed and illustrated by computed results for three test problems. In this comparison we have focused our attention entirely upon the performance of schemes for differencing the hydrodynamic equations. We have regarded the nature of the grid upon which such differencing schemes are applied as an independent issue outside the scope of this work. Therefore we have restricted our study to the case of uniform, square computational zones in Cartesian coordinates. For simplicity we have further restricted our attention to two-dimensional difference schemes which are built out of symmetrized products of one-dimensional difference operators.

38731 Liquid helium. Svensson, E.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Brookhaven National Lab., Upton, NY (USA)). pp 261-266 of Neutron and its applications, 1982. Plenary and invited papers from the conference to mark the 50th anniversary of the discovery of the neutron held at Cambridge, 13-17 September 1982. Schofield, P. (ed.). Bristol, England; Institute of Physics (1983). (CONF-820950—).

From Conference on the neutron and its applications; Cambridge, UK (13 Sep 1982).

Recent neutron-scattering studies on liquid ^{4}He which have led to a simplified interpretation of the dynamics and to new values for the condensate fraction are summarised.

6450 High Energy Physics

38732 (DOE/ER/03230—T3) Research in elementary particle physics. Technical progress report, June 1, 1983-May 31, 1984. Kirsch, L.E.; Schnitzer, H.J.; Bensinger, J.R.; Abbott, L.F. (Brandeis Univ., Waltham, MA (USA). Dept. of Physics). 1984. Contract AC02-76ER03230. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013520.

Under this contract, research has been performed on both the theoretical and experimental properties of elementary particles. A brief description of the work which is either in progress or has been completed is given. Publications are listed.

38733 (DOE/ER/40085—5) High energy physics at Tufts University. Progress report, August 1, 1983-July 31, 1984. (Tufts Univ., Medford, MA (USA)). 1984. Contract AC02-83ER40085. 114p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015437.

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Experimental studies described include the Sudan-II nucleon decay project, photoproduction studies at the SLAC hybrid facility, neutrino physics, multiparticle spectrometer studies at Fermilab, anti pN interactions: SLAC BC-68, and a streamer chamber study of anti k^{*0}(890): SLAC E-131. Theoretical studies include a general kinematic description of polarization processes and applications of QCD perturbation theory. (WHK)

38734 (LBL—17867) XIXth Rencontre de Moriond on electroweak interactions and unified theories: summary talk. Goldhaber, G. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 29p. (CONF-8403121—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014593.

From New particle production at high energy meeting: The Recontre de Moriond; La Plagne, France (4 Mar 1984).

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Topics discussed at the XIXth Rencontre de Moriond on electroweak interactions and unified theories are briefly discussed. (WHK)

38735 (RL—83-085) Databases and bookkeeping for HEP experiments. Report of Subgroup II of the ECFA Working Group on Data Processing Standards. Blobel, V.; Cnops, A.-M.; Fisher, S.M. (Rutherford Appleton Lab., Chilton (UK)). Sep 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702548.

The term database is explained as well as the requirements for data bases in High Energy physics (HEP). Also covered are the packages used in HEP, summary of user experience, database management systems, relational database management systems for HEP use and observations.

38736 (UM-P—83/76) Matter - its ultimate structure. Opat, G.I. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702543.

Recent theoretical and experimental developments in our understanding of the basic constituents of matter and their interactions are reviewed.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 64510038180, 38181, 38183, 38281, 38330, 38763, 38804, 38807, 38878, 38878

38737 (BNL—34910) Search for proton decay: introduction. Goldhaber, M. (Brookhaven National Lab., Upton, NY (USA)). 26 Feb 1984. Contract AC02-76CH00016. 4p. (CONF-840280—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014349.

From Recontre de Moriond meeting on electro weal interactions and unified theories; La Plaque, France (26 Feb 1984).

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In interpreting contained events observed in various proton decay detectors one can sometimes postulate, though usually not unambiguously, a potential decay mode of the proton, called a candidate. It is called a candidate, because for any individual event it is not possible to exclude the possibility that it is instead due to cosmic ray background, chiefly atmospheric neutrinos. Some consistency checks are proposed which could help establish proton decay, if it does occur in the presently accessible lifetime window.

38738 **(BNL—34936) Hadron physics.** Bunce, G. (Brookhaven National Lab., Upton, NY (USA)). 30 May 1984. Contract AC02-76CH00016. 17p. (CONF-8405193—27). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014563.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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Is all hadronic physics ultimately describable by QCD? Certainly, many disparate phenomena can be understood within the QCD framework. Also certainly, there are important questions which are open, both theoretically (little guidance, as yet) and experimentally, regarding confinement. Are there dibaryons, baryonium, glueballs? In addition, there are experimental results which at present do not have an explanation. This talk, after a short section on QCD successes and difficulties, will emphasize two experimental topics which have recent results - glueball spectroscopy and exclusive reactions at large momentum transfer. Both are experimentally accessible in the AGS/LAMPF II/AGS II/TRIUMF II/SIN II energy domain.

38739 **(DOE/ER/01195—T5) Measurement of chi(3510) and chi(3555) production in 190 GeV/c piminus-beryllium interactions.** Lukens, P.T. (Illinois Univ., Urbana (USA). Dept. of Physics). 1984. Contract AC02-76ER01195. 165p. (COO—1195-494). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015133.

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Charmonium production in 190 GeV/c π^--Be interactions has been observed. The states chi(3510) and chi(3555) are seen through their radiative decay into J/Psi, and are found to correspond to 0.29 +- 0.09 of total J/Psi production for J/Psi's with x/sub f/ $>$ 0.2. The rate of production for the two chi states appears as Bσ(chi(3555))/Bσ(chi(3510) = 0.60 +- 0.35. The fraction of J/Psi's produced through chi decay appears to rise with higher x/sub f/. For J/Psi's with x/sub f/ $>$ 0.42, chi decay is responsible for 0.345 +- 0.09 of the total J/Psi sample, with the two states produced at the rate Bσ(chi(3555))/Bσ(3510) = 0.82 +- 0.45.

38740 **(DOE/ER/01195—T6) Comparison of pion- and proton-production of charmonium.** Graff, T.L. (Illinois Univ., Urbana (USA). Dept. of Physics). 1984. Contract AC02-76ER01195. 151p. (COO—1195-493). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84015351.

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Charomium chi states produced in π^--beryllium interactions at 190 GeV/c and in proton-beryllium interactions at 200 GeV/c and 250 GeV/c have been observed via their decay into J/Psi + γ. This experiment was carried out with the Chicago Cyclotron Magnet Spectrometer at Fermilab. The fraction of J/Psi's resulting from chi decay is measured to be 0.33 +- 0.07 for incident pions and 0.47 +- 0.21 for incident protons. The chi(3510) and chi(3555) are produced in roughly equal numbers for pions, but the chi(3555) dominates for protons. Simple gluon fusion accounts for chi production by protons. This is reasonable considering the lack of valence antiquarks in the proton-beryllium system. Other mechanisms are needed to explain chi production by pions.

38741 **(DOE/ER/03130—10) Measurement of the elastic scattering of muon neutrinos from electrons at the AGS.** Hughlock, B.W. (Brown Univ., Providence, RI (USA). Dept. of Physics). Jun 1983. Contract AC02-76ER03130. 168p. (COO—3130TC-10). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84014106.

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One aspect of a comprehensive experimental investigation of neutrino interactions, the elastic muon neutrino-electron scattering, is described. The principle goal is a measurement of the cross section of neutrinos and antineutrinos from electrons and an accurate determination of the only free parameter of the Weinberg-Salam theory, the Weinberg angle. The experiment is also designed to measure the semileptonic exclusive processes of elastic scattering, the charged current quasi-elastic reaction, nu/sub μ/n$\rightarrow\mu$p, and single pion production. Additionally, the transverse polarization of the proton in the reaction nu/sub μ/n$\rightarrow\mu$p at moderate q^2 may be measured to test time reversal invariance. The work reported is a study of the nu/sub μ/e$\rightarrow$nu/sub μ/e reaction. (LEW)

38742 **(DOE/ER/03130—258) Progress report of a research program in experimental high energy physics, 1 January-31 December 1984.** Widgoff, M. (Brown Univ., Providence, RI (USA)). 01 Jul 1984. Contract AC02-76ER03130. 59p. (COO—3130TB-258). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84013718.

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An experimental program to study the interactions of hadrons, photons, and neutrinos is being carried out using hybrid systems which include bubble chambers as visible targets and counter spectrometers for particle detection, identification, and momentum measurements. Experiments have been run in both positive and negative hadron beams at Fermilab, and with polarized photons at SLAC. Experiments with neutrino beams at Tevatron II at Fermilab are in preparation. We have been analyzing the film and counter data of our one-million-picture exposure for the study of π+-, K^+ and p interations in hydrogen and magnesium, silver and gold, at a beam momentum of 200 GeV/c, as well as continuing the physics analysis of our earlier FNAL experiments on π^+p, K^+ p, and pp interactions at 147 GeV/c. During the past year analysis has continued on the data of SLAC experiments studying the interactions in hydrogen of 20 GeV polarized photons. Results have been obtained on photoproduction of charm and on the lifetimes of charmed particles, and on vector meson and strange particle production. Inclusive γp interactions are being studied in detail in this high statistics sample. Another experiment, was run at 10.5 GeV, to search for evidence of a predicted threshold enhancement in the charm photoproduction cross section. Preparations are in progress for neutrino interaction studies at Tevatron II. An experiment will run starting early in 1985 in the wide band neutrino beam with hybrid system designed for the tau neutrino search to be run with the beam dump.

38743 **(DOE/ER/13065—390) Cross sections, x/sub F/ dependence and A dependence.** Ritchie, J.L.; Bodek, A.; Breedon, R.; Coleman, R.N.; Barish, B.C.; Messner, R.L.; Merritt, F.S.; Fisk, H.E.; Donaldson, G.; Wojcicki, S.G. (Rochester Univ., NY (USA); California Inst. of Tech., Pasadena (USA); Chicago Univ., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA); Stanford Univ., CA (USA)). 1984. Contract AC02-76ER13065. 12p. (CONF-8405193—23). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014623.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

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We have investigated the production of charmed particles with x/sub F/ $>$ .2 with 350 GeV protons and 278 GeV π^-'s on iron by studying prompt single muon production for p/sub μ/ $>$ 20 GeV/c. Charm production cross sections and x/sub F/ distributions are presented. By comparing these results with other measurements on different nuclear targets, it is possible to infer the atomic weight A dependence of hadronic charm production.

38744 **(ITEF—134(1983)) Comparative study on the inclusive reactions of πp A $\rightarrow \pi^+$X on the lithium isotopes at 2,6 GeV/c.** Abramov, B.M.; Dukhovskij, I.A.; Kishkurno, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702547.

Differential cross sections for π^-^{6}Li$\rightarrow\pi$+X and π^-^{7}Li$\rightarrow\pi$+X inclusive reactions in the hard port of pulse spectrum of π^+-mesons are measured under similar experimental conditions. Comparative study on difference of the obtained cross sections with difference of cross sections in the π^-p$\rightarrow\pi^+$X and π^-d$\rightarrow\pi^+$X reactions is conducted. It is disclosed that in the region of masses Msub(x)sup(2)=(Esub(πsup(-))-Esub(πsUp(+))+Msub(p))sup(2)-(Psub(πsup(-)) vector-Psub(πsUp(+)) vector)sup(2) $<$ 1.5 GeV^2 the values of both differences coincide in the limit of experimental errors while for Msub(x)sup(2) $>$ 1.5 GeV^2 difference of cross sections on lithium isotopes is close to zero in contrast to noticeable difference of cross sections on hydrogen and deuterium.

38745 (LA—9933-C-Vol.2, pp 663-665) **Facilities for electorweak physics.** Mischke, R.E. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The possibilities for hyperon, kaon, pion, muon and neutrino experiments at LAMPF-II are briefly reviewed as an introduction to a section of separate papers on these subjects. The advantages of LAMPF-II for these experiments are emphasized.

38746 (LA—9933-C-Vol.2, pp 666-671) **Hyperon physics.** Heller, K. (Univ. of Minnesota, Minneapolis). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The conclusion of this workshop is that a general purpose LAMPF II hyperon beam while practical would not be as useful as one built at the Tevatron. Of course the same physics will be accessible to both beams and a hyperon beam may not be available at the Tevatron. In addition any experiments requiring exlcusive processes for producing tagged hyperons in an open geometry would be easier at the lower LAMPF II energy but would not require constructing a hyperon beam.

38747 (LA—9933-C-Vol.2, pp 688-690) **Rare π and μ decays.** Highland, V.L. (Temple Univ., Philadelphia, PA). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Because the active programs at current meson facilities make the state of knowledge in the era of LAMPF II very uncertain, this session did not address any specific experimental plans. There was confidence that there would be enduring interest in rare muon decays. Even if one of the reactions $\mu \rightarrow e\gamma$, $\mu \rightarrow e\gamma\lambda$, $\mu \rightarrow eee$, $\mu^- Z \rightarrow$anti-$e^- Z$, or $\mu^+ e^- \rightarrow \mu^- e^+$ were discovered in the next decade, the next step would be to find the remaining reactions and to measure spectra. Likewise, ever more precise measurements of allowed pion decays (such as $\pi^+ \rightarrow \pi^0$enu, $\pi \rightarrow$enu, $\pi^0 \rightarrow e^+ e^-$, and $\pi^0 \rightarrow \gamma e^+ e^-$) will be worthwhile, and the forbidden decay $\pi^0 \rightarrow \gamma\gamma\gamma$ will be of increasing interest as the upper limit on it is made smaller.

38748 (LA—9933-C-Vol.2, pp 813-819) **Report of the Hypernuclear Physics Working Group.** Hungerford, E.; Stein, N. (Univ. of Houston, TX). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The Hypernuclear Physics Working Group meeting was organized into two sections with the first devoted to presentations and discussions of experiments and programs that have been proposed for LAMPF II. As evidenced by the presentations, considerable polish and refinement has been applied to these proposals since the last workshop. In the second part of this meeting there was a panel and group discussion on the "next round" of hypernuclear physics experiments, which focused on new directions that should be pursued and present experiments that should be extended. The question of how a facility such as LAMPF II would accomplish these goals was an important part of the discussion. This report summarizes the comments of the various speakers, the panel members, and working group participants.

38749 (LA—9933-C-Vol.2, pp 827-832) **Separate kaon beam-line workshop.** Chrien, R.E. Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

As an introduction to the workshop existing separated kaon beam lines are briefly reviewed. Recent research in hypernuclear physics is mentioned and beam requirements for future research are considered.

38750 (LA—9933-C-Vol.2, pp 672-677) **Study of the semileptonic decays of polarized hyperons at LAMPF II.** Romanowski, T.A. (Ohio State Univ., Columbus). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The relevant physics questions that can be investigated in precision experiments with semileptonic decays of polarized hyperons are: a stringent test of Cabibbo's model; a search for the existence of right-handed currents in $\Delta s = 1$ transitions; a search for CP violation in these decays; and a search for the existence of second-class currents in the semileptonic Σ/sup +/-/$\rightarrow \Lambda\beta$antiν decays. The experiments addressing the first two of these questions will require at least 10^8 fully kinematically reconstructed semileptonic hyperon decays. CP-violation will require 10^7-10^8 and the search for second class currents will need 10^5-10^6.

38751 (LA—9933-C-Vol.2, pp 802-804) **Hyperon-nucleon strong interactions.** Gibson, B.F.; Riley, P.J. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Discussions occuring during this session are summarized. Topics addressed include: hyperon-nucleon interactions below a momentum of 450 MeV/c, time separated beams and the proton-antiproton to hyperon-antihyperon reaction, Xi and omega scattering experiments, antihyperon-proton scattering, hypernuclear spectroscopy, and uses of polarized beams and targets. The need for quality low momentum data was emphasized.

38752 (LA—9933-C-Vol.2, pp 730-737) **Summary of the parallel sessions on strong interactions.** Bonner, B.E.; Riley, P.J. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Reports given at several sessions on strong interactions are summarized. Topics covered include: nucleon-antinucleon interactions and facilities; nucleon-nucleon experiments, theory and facilities; meson-nucleon interactions; and hyperon strong interactions. Possibilities for experiments at LAMPF-II are discussed.

38753 (LA—9933-C-Vol.2, pp 820-822) **(π, kappa) studies at Brookhaven National Laboratory.** Amann, J.; Milner, C. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

A measurement of the (π^+, kappa$^+$) reaction using the C2 beam line at Brookhaven at an incident pion momentum of 1050 MeV/c has been performed. The pion flux was typically 5 X 10^6 per spill and was limited primarily by count-rate considerations in the beam-line scintillators. A natural carbon target (scintillator) was studied at laboratory scattering angles of 5, 10, and 15°; a natural silicon target, at 10°. Energy resolution was 3-4 MeV and was dominated by taret-thickness effects. A preliminary spectrum was taken at ground state (ΛS/sub 1/2/, nup/sub 3/2/$^{-1}$) and a state at ~11-MeV higher excitation, which is most likely a combination of (Λp/sub 1/2/, nup/sub 3/2/$^{-1}$)2^+ and (Λp/sub 3/2/, nup/sub 3/2/$^{-1}$)2^+.

38754 **(MPI-PAE-Exp.El.—126) Study of hadronic decays of the ν'.** Fonseca, V.; Mageras, G.; Dietl, H.; Eigen, G.; Lorenz, E.; Pauss, F.; Vogel, H.; Son, D.; Franzini, P.; Tuts, P.M. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Feb 1984. 40p. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik.

We present a detailed study of the decays $\nu' \rightarrow \pi^+ \pi^- \nu$ and $\nu' \rightarrow \pi^0 \pi^0 \nu$, where the upsilon decays subsequently to $e^+ e^-$ or

$\mu^+\mu^-$. The results are obtained from a sample of 146,000 ν' decays observed with the CUSB detector at the Cornell Electron Storage Ring. We derive branching fractions of (18.9+-2.6)% for ν'->$\pi^+\pi^-\nu$ and (10.3+-2.3)% for ν'->$\pi^0\pi^0\nu$, and determine partial widths for these decays. Invariant mass and angular distributions of both the $\pi^+\pi^-$ and $\pi^0\pi^0$ systems are presented. We also set a limit on the branching fraction for ν'->etav of less than 0.2% at the 90% confidence level.

38755 **(UM-P—83/51) Study of the reaction (anti p)n → $\pi^-\pi^-\pi+$ at centre of mass energies between 1.9 and 2.3 GeV.** Darling, T.; Opat, G.I.; Tovey, S.N.; Wignall, J.W.G. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702549.

The reactions (anti p)n → $\pi^-\pi^-\pi^+(\pi^0)$ at incident momenta between 0.42 and 1.65 GeV/c have been studied using two exposures in deuterium filled bubble chambers. The ratio of the rates for 3π to 4π final states shows a sharp increase at a momentum of about 0.8 GeV/c. A full Partial Wave Analysis of the 3π final state has been made and complex structure is observed at approximately the same momentum, associated in particular with the J/sup P/=3^+ final state.

38756 **(UM-P—83/61) Analysis of antinucleon-nucleon annihilations at rest into pions.** Kasper, P.H.; Opat, G.I.; Carmony, D.D. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702546.

The reactions (anti p)p → $3\pi^0$ and (anti p)n → $\pi^+\pi^-\pi^-$ at rest are analysed. The amplitudes used (a) allow for P-wave as well as S-wave initial states, (b) have intermediate dipion states parametrised with experimentally determined $\pi\pi$ scattering phase shifts and elasticities and (c) fit the data for (anti p)p and (anti p)n annihilations concordantly. Apart from an anomaly in the mass region 1.15 GeV/c^2, good fits to both data samples are obtained.

38757 **Search for Q = (2/3)e and Q = (1/3)e particles produced in e^+e^- annihilations.** Aihara, H.; Alston-Garnjost, M.; Badtke, D.H.; Bakken, J.A.; Barbaro-Galtieri, A.; Barnes, A.V.; Barnett, B.A.; Blumenfeld, B.J.; Bross, A.D.; Buchanan, C.D.;. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720; University of California, Los Angeles, California 90024; University of California, Riverside, California 92521; Johns Hopkins University, Baltimore, Maryland 21218; University of Massachusetts, Amherst). *Physical Review Letters;* **52**: No. 26, 2332-2335(25 Jun 1984). Contract AC02-76ER03330.

In a search for heavy Q = (2/3)e and Q = (1/3)e particles produced in e^+e^- collisions at a center-of-mass energy of 29 GeV, no candidate events were found in 77 pb^{-1} of data collected by the time projection chamber at PEP. Upper limits are established on the inclusive cross section for the production of Q = (2/3)e and Q = (1/3) particles in the mass range 1—13 GeV/c^2, improving upon previously established limits.

38758 **Evidence for a second F_{35} pion-nucleon resonance near 2000 MeV.** Manley, D.M. (Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Physical Review Letters;* **52**: No. 24, 2122-2125(11 Jun 1984). Contract AS05-76ER04928.

A recent isobar-model, partial-wave analysis of πN->$\pi\pi N$ finds strong indications of the F_{35} pion-nucleon resonance belonging to the (70, L = 2^+) baryon multiplet. This conclusion is drawn from recent predictions of baryon decays obtained with baryon compositions determined by the Isgur-Karl quark model. The highly inelastic F_{35} resonance is observed through its dominant p-wave decay to rhoN. .AE

38759 **Observation of the decay eta/sub c/→phiphi and determination of the eta/sub c/ spin and parity.** Baltrusaitis, R.M.; Becker, J.J.; Blaylock, G.T.; Brown, J.S.; Bunnell, K.O.; Burnett, T.H.; Cassell, R.E.; Coffman, D.; Cook, V.; Coward, D.H. (Mark III Collaboration California Institute of Technology, Pasadena, California 91125). *Physical Review Letters;* **52**: No. 24, 2126-2129(11 Jun 1984). Contract AC03-76SF00515.

In a study of 2.7 million J/psi decays with the Mark III, a new magnetic detector at SPEAR, we have observed the sequential decay J/psi→yeta/sub c/, eta/sub c/→phiphi. The product branching fraction is (1.02 +- 0.25 +- 0.14) x 10^{-4}, where the quoted errors are statistical and systematic, respectively. Analysis of the final-state angular distributions provides the first experimental determination that the spin and parity of the eta/sub c/ are 0^-.

38760 **Review of particle properties.** Wohl; Cahn, R.N.; Rittenberg, A.; Trippe, T.G.; Yost, G.P.; Porter, F.; Hernandez, J.J.; Montanet, L.; Hendrick, R.E.; Crawford, R.L. *Reviews of Modern Physics;* **56**: No. S2, S1-S304(1 Apr 1984). Contract AC03-76SF00098.

This review of the properties of leptons, mesons, and baryons is an updating of the Review of Particle Properties, Particle Data Group [Phys. Lett. 111B (1982)]. Data are evaluated, listed, averaged, and summarized in tables. Numerous tables, figures, and formulae of interest to particle physicists are also included. A data booklet is available.

38761 **Hadronic production of prompt muons.** Coleman, R.N.; Barish, B.C.; Bodek, A.; Breedon, R.; Marsh, W.; Messner, R.L.; Olsen, S.; Ritchie, J.L.; Shaevitz, M.H. (Fermilab, Batavia, IL). pp 535-544 of The search for charm, beauty, and truth at high energies. Vol. 16. Bellini, G. New York, NY; Plenum Publishing Corp. (1984). (CONF-811195—).

From Europhysics conference on the search for charm, beauty and truth at high energy; Erice, Italy (15 Nov 1981).

This chapter reports the results from the p 20 GeV/c trigger performed at Fermilab. Prompt single muon results (350 GeV p-Fe) and prompt 2 + missing energy are considered. The new data provide a substantial improvement in the low momentum region and also allow a comparison of proton and pion induced prompt muon production. Density extrapolations were used to separate prompt muons from muons originating from the decays of long lived particles. The muon identifier identified all muons produced with a laboratory momentum greater than 5 GeV/c. Muon energies below 15 GeV were determined from their range in the muon identifier. Muon energies above 15 GeV were determined by use of toroidal magnets placed at the downstream end of the detector.

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REFER ALSO TO CITATION(S) 64520038748, 38749, 38750, 38792, 38804, 38817, 38874, 38876, 38878, 38882, 38912

38762 **(ANL-HEP-CP—84-18) Searching for top, Higgs, and supersymmetry: the minimum invariant mass technique.** Berger, E.L. (Argonne National Lab., IL (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 05 Mar 1984. Contract W-31-109-ENG-38. 15p. (CONF-8403121—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014539.

From New particle production at high energy meeting: The Recontre de Moriond; La Plagne, France (4 Mar 1984).

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Supersymmetric particls, Higgs mesons, the top quark and other heavy objects are expected to decay frequently into three or more body final states in which at least one particle, such a neutrino or photino, is non-interacting. A method is described for obtaining an excellent estimate of both the mass and the longitudinal momentum of the parent state. The probable longitudinal momenta of the non-interacting particle a..l of the parent, and the minimum invariant mass of the parent are derived from a minimization procedure. The distributions in these variables are shown to peak sharply at their true values.

38763 (BNL—34932) Hard quark-quark scattering with exclusive reactions. Barton, D.S.; Bunce, G.M.; Carroll, A.S.; Makdisi, Y.I.; Baller, B.; Blazey, G.C.; Courant, H.; Heller, K.J.; Heppelmann, S.; Marshak, M.L. (Brookhaven National Lab., Upton, NY (USA); Minnesota Univ., Minneapolis (USA); Southeastern Massachusetts Univ., North Dartmouth (USA)). 19 Jul 1984. Contract AC02-76CH00016. 10p. (CONF-840757—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014375.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

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We have begun a program designed to study hard quark-quark scattering with exclusive reactions, focusing on quasi-elastic two-body reactions with all possible quark flavor exchanges. Examples are $\pi^- p \to \pi^- p$, rho$^-$p, $\pi^+\Delta^-$, $K^+\Sigma^-$, or KΛ. Of the two-body exclusives, only elastic scattering had been measured at such large t previous to our experiment. By comparing the relative importance of different final states, the energy dependence of the production ratios of these states, the prominence of resonances such as rho$^-$ over background in this region, and measuring polarizations where accessible, we have collected a large body of data on hard scattering in a completely new domain. Previously, essential all short distance QCD tests have been for inclusive processes. We have taken data with both negative and positive incident beam at 10 GeV/c on a hydrogen target and will present the first results, for $\pi^- p \to \pi^- p$ and rho$^-$p at Θ/sub cm/ = 90°, -t = 9 GeV^2/c^2. The apparatus consists of a magnetic spectrometer, with Cerenkov particle identification, which selects stable charged particles (protons in this case) at high momentum near 90° in the center-of-mass. A large aperture array of PWCs observes the recoil particle or charged decay products. Cross sections are extremely low, approximately a 1 nb/(GeV/c)^2 for elastic scattering. We will report on a sample of more than 1000 π^-p elastic events, and on rho$^-$p, where the rho$^-$ decay distribution was observed. We find a surprisingly large rho$^-$p cross section in this large momentum transfer region, with rho$^-$p about half the elastic cross section, and a striking spin alignment of the rho$^-$.

38764 (DOE/ER/03130—2) Task D-computational physics. Progress report for the year 1984. (Brown Univ., Providence, RI (USA). Dept. of Physics). 17 Jul 1984. Contract AC02-76ER03130. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014671.

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The first stage of work on low lying hadron masses calculated (in the quenched approximation) on lattices of size 12^3 x 32 at beta = 6.31 is briefly reported. This value of beta requires lattices at least as large as the ones being worked on in order to avoid locking of the degrees of freedom. This beta puts us far closer to the correct weak coupling regime than any other calculation has been. Indeed, it can be argued that essentially all other calculations with beta = 6.0 or less are little more than strong coupling calculations. Results are exciting and better than originally had been expected. The predicted mass spectrum is in marked closer agreement to the physically observed spectrum than previous results. For example, the proton mass is within 100 MeV of its actual value and the rho-proton mass ratio is in essentially exact agreement with its experimental value. (WHK)

38765 (DOE/ER/03130—366) Progress report for a research program in theoretical high-energy physics. Feldman, D.; Fried, H.M.; Jevicki, A.; Kang, K.; Tan, C.I. (Brown Univ., Providence, RI (USA). Dept. of Physics). 30 Jun 1984. Contract AC02-76ER03130. 19p. (COO—313-TA-366). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013717.

New results have been reached in: geometric structures of symmetry breaking and contracted symmetry groups; relevant differential forms and cohomology theory; continuum strong coupling methods by infrared extraction; fermions in quenched and non-quenched approximations in both Abelian and non-Abelian infrared models; methods of approximating ordered exponentials in opposite strong-coupling limits; field theoretical methods for fluid dynamics; dynamical SUSY breaking; non-Abelian monopoles in Kaluza-Klein theories; dual, non-linear sigma models in supergravity; global SUSY; skyrmions; new approaches to lattice gravity; grand unification models involving the invisible axion and cosmological constraints; naturalness criteria and color anomalies; multiple fermion generations without domain walls as criteria for uniqueness of allowable GUT models; the mass hierarchy problem; axion implications for cosmology; anomalies and anomly-free representations of gauge theories; a field theoretic explanation of the quantum Hall effect, localization, and two-dimensional electron gases; chirally invariant lattice gauge theories, and the unacceptability of the SLAC model; axial anomalies in compact manifolds with boundary conditions; simulation of Weyl fermion theories; the correct criteria for exponential decay of correlation functions in quantum lattice theories; a formulation of a quantum lattice theory of gravitation; phase transitions in a variety of lattice gauge theories using an improved Migdal-Kadanoff RG procedure; polarized photon structure functions; Monte Carlo estimates of hadronic masses and numerical studies of Gribov gauge ambituities; Hamiltonian quantization of an SL(2,C) gauge theory; variational approach to lattice ground states; and planar and non-planar lattice QCD surfaces in the large-N limit.

38766 (DOE/ER/70004—315) Forward production of baryons in quark and gluon jets. Eilam, G.; Zahir, M.S. (Oregon Univ., Eugene (USA). Inst. of Theoretical Science). Jun 1981. Contract AT06-76ER70004. 15p. NTIS MF A01. Order Number DE82008365.

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Inclusive production of protons in quark and gluon jets is calculated in perturbative QCD and recombination model. We first calculate the inclusive distribution of a parton jet to decay into three quarks, and then recombine them to form a proton. The computation is performed in the framework of the same model that successfully describes the production of pions in parton jets. Our results, which are applicable to $x \geqq 0.5$ show a small production of baryons with $p/\pi \sim 1\%$. We point at other possible sources of baryons which must be operative if the low x data showing abundant production of baryons will persist at higher x and high q^2.

38767 (JINR—E-2-83-533) Next-next-to-leading perturbative QCD corrections and light quark masses. Gorishny, G.; Kataev, A.L.; Larin, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702541.

The three-loop perturbative corrections to the (pseudo) scalar quark current correlator are calculated. They amount to about 20% of the leading term at anti αsub(s) approximately 0.25. Taking sum rules into account and exploiting finite energy masses the following values of light quarking are obtained: msub(u) (1 GeV) approximately 5 MeV, msub(d) (1 GeV) approximately 11 MeV, msub(s) (1 GeV) approximately 195 MeV. The phenomenological predictions of "linear dual models" for radial excitations of the K, delta, and k mesons are discussed.

38768 (JINR—E-2-83-615) Self-consistent calculation of the weak constants in the parity nonconserving nuclear forces. PNC in the rhoNN and ωNN vertices. Dubovik, V.M.; Zenkin, S.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702542.

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The quark structure of the parity nonconserving (PNC) rhoNN and ωNN vertices is considered for the effective PNC Hamiltonian of the standard model SU(2)sub(L)xU(1)xSU(3)sub(c). Without arbitrary (fitting) parameters all the contributions to the constants hsub(rho)sup(0, 1, 2) and hsub(ω)sup(0,1) of the PNC NN potential are calculated. Nonfactorizable (NF) contributions to the constants are calculated proceeding from the approximate SU(6) symmetry of matrix elements in the MIT bag model. The obtained values of hsub(rho)sup(0, 1, 2) and hsub(ω)sup(0, 1) agree with the "best values" of hsub(rho, ω) of Desplanques, Donoghue and Holstein.

38769 (LA—9933-C-Vol.2, pp 823-826) **Pion and γ-ray spectroscopy with polarized hypernuclei.** Masaike, A.; Ejiri, H. (National Lab. for High-Energy Physics, Tsukuba, Japan). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Hypernuclear spectroscopy is quite powerful for studying strangeness-changing weak decays and hypernuclear structure. Spin alignment and spin polarization are particularly useful for spectroscopic studies, as already has been proved in in-beam nuclear spectroscopy. The present report is concerned with possible spectroscopic studies with polarized hypernuclei.

38770 (LA—9933-C-Vol.2, pp 1018-1036) **Concluding remarks.** Walecka, J.D. (Stanford Univ., CA). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

A personal perspective on the status and accomplishments of nuclear and high energy physics is given. The traditional approach to nuclear physics is described and the sucesses of various nuclear models are reviewed. In particle physics the Standard Model and Quantum Chromodynamics are discussed. The role of LAMPF II can play in answering oustanding questions is considered.

38771 (LA—9933-C-Vol.2, pp 1012-1017) **Electroweak interactions and beyond.** Rosen, S.P. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Principal goals of LAMPF II experiments involving electroweak interactions are summarized. Areas to be investigated are: neutrino physics, kaon decay hyperon decay, glue balls, and exclusive meson-nucleon interactions.

38772 (LA—9933-C-Vol.2, pp 628-639) **Time dependence of neutron polarization in hydrogen muon capture: a possible experiment for LAMPF II?.** Deutsch, J. (Louvain Univ., Louvain-la-Neuve, Belgium). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The precision measurement of the muon-nucleon couplings in second generation hydrogen muon-capture experiments is discussed. The physical basis and the observables in such experiments are briefly described. The later include: capture rates; neutron asymmetry; and, in particular, neutron polarization. A neutron polarimeter to be used with LAMPF-II muon capture experiments is proposed.

38773 (LA—9933-C-Vol.2, pp 785-790) **Spectroscopy of baryons with light quarks.** Cutkosky, R.E. (Carnegie-Mellon Univ., Pittsburgh, PA). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The following three questions are briefly discussed: What are some of the unresolved problems of empirical baryon spectroscopy? What theoretical problems concerning QCD, quark dynamics, and baryon structure require better understood baryon resonances? What kinds of experimental data could help to determine baryon resonances better?

38774 (LA—9933-C-Vol.2, pp 989-1011) **Hadronic physics with LAMPF II - a summary.** Eisenber, J.M. (Tel Aviv Univ., Israel). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The hadronic physics discussed in the Third LAMPF II Workshop is summarized, with emphasis on topics that demand extensive further study before our understanding of strongly interacting systems can be said to be complete.

38775 (LA—9933-C-Vol.2, pp 562-579) **Large momentum transfer exclusive scattering: small cross sections but big rewards.** Farrar, G.R. (Rutgers Univ., New Brunswick, NJ). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

QCD predicts that a large number of hadronic scattering reactions depend on a small number of fundamental quark scattering amplitudes. A systematic program of measurement of the cross sections for various high-p /sub perpendicular to/ exlusive reactions, such as $\pi^- p \to \pi^- p$, $\pi^+ p \to K^+ \Sigma^+$, etc., will permit a comprehensive study of QCD. Not only can QCD calculations of the scattering amplitudes be tested in unprecedented detail, but the applicability of the perturbative approximation in the actual experimental conditions can be determined independently, experimentally. Furthermore measurement of a sufficiently large number of the possible reactions permits determination of the phases of the amplitudes, which are of great theoretical interest because of their relevance to the question of Sudakov suppression.

38776 (LA—9933-C-Vol.2, pp 930-946) **Formation and decay of the Λ(1520) resonance in ^{12}C.** Plendl, H.S. (Florida State Univ., Gainesville). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The possibility of producing Λ(1520) in ^{12}C and of determining changes in resonance energy, lifetime, and branching ratios that are related to the quark substructure of the interacting baryons is considered. Such a determination is feasible in the presence of Fermi motion and other effects related to the ordinary aspects of nuclear structure, provided kinematically complete measurements of the resonance decay products are made.

38777 (LA—9933-C-Vol.2, pp 947-951) **Prompt gamma-ray studies of K/sup +/-/ interactions on nuclei.** Lind, V.G. (Utah State Univ., Logan). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Prompt nuclear gamma rays from experiments of fast K/sup +/-/ interactions with nuclei provide a powerful and unique method for studying K-meson absorption and scattering in nuclei as well as the formation and decay of numerous hypernuclei and, hence, the role of the strange quark in the nuclear environment. Nuclear structure information also may be obtained from such experiments.

38778 (LA—9933-C-Vol.2, pp 748-765) **Bag model six-quark states and nucleon-nucleon scattering.** Lomon, E.L. (Massachusetts Inst. of Tech., Cambridge). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The apparent overlap of the short-range region of asymptotic freedom of quarks with the long-range region of effective hadron clusters permits the application of R-matrix methods to hadron-hadron reactions. The f-matrix formalism is particularly suitable and extends the ideas of the P-matrix method. Applications of the latter indicate that transition region effects are important. This implies that the f-matrix conditions should be applied at somewhat smaller radii than that of the equilibrium bag in order that asymptotic freedom may be assumed. Application to the nucleon-nucleon system in $^1S_0$ and $^3S_1$ states shows that the original MIT bag model and a new bag model with negative-quark self-energies are inconsistent with the present data for laboratory energy E/sub L/ less than or equal to 800 MeV. The cloudy-bag model with a boundary at R = 0.9 fm is consistent with the data and predicts structure at about 2.7-GeV mass with well-defined signature in terms of width, inelasticity, and singlet-triplet splitting. The position of the structure is sensitive to the bag model assumptions. Many such structures are expected in hadron-hadron collisions at a few GeV that would enable the specification of several aspects of quark-gluon dynamics.

38779 (LA—9933-C-Vol.2, pp 778-784) **Anomalons, hidden colour, and the N-N system.** Watson, P.J.S. (Carleton Univ., Ottawa, Ontario). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The possibility that long-lived multi-quark states exist is considered. Three specific models are outlined and what kinds of experiments could be performed are discussed.

38780 (LA—9933-C-Vol.2, pp 952-959) **Droplet model of fragmentation: implications for LAMPF II.** Porile, N.T.; Bujak, A.; Finn, J.E.; Gutay, L.J.; Hirsch, A.S.; Minich, R.W.; Scharenberg, R.P.; Stringfellow, B.C.; Turkot, F. (Purdue Univ., West Lafayette, IN). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Energy spectra of isotopically resolved fragments with A = 4-30 from the interaction of 30-350-GeV protons with Kr and Xe have been measured. The observation of a power law mass yield distribution suggests a description of fragmentation as a multifragment breakup process of a residual nucleus excited to the vicinity of its critical point. The classical droplet model of M.E. Fisher has been adapted to nuclear fragmentation and can account for the isotopic yield distributions as well as the kinetic energy spectra. The implications of this model for LAMPF II experiments are examined.

38781 **(RL—83-102) Energy dependent partial wave analysis of πi p$\rightarrow$ K^+ σ^+ between threshold and 2.35 GeV.** Candlin, D.J.; Lowe, D.C.; Peach, K.J. (Rutherford Appleton Lab., Chilton (UK)). Nov 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702545.

An energy dependent partial wave analysis of the reaction $\pi^+ p \rightarrow K^+ \Sigma^+$ has been carried out between threshold and 2.35 GeV centre of mass energy using recently published, high statistical precision data. A single solution giving a satisfactory fit to the data has been found. In the region below 2 GeV the resonant features of the solution are compared with the QCD based model of Koniuk and Isgur. Above 2 GeV the states listed in the Particle Data group tables with two or more stars are observed but none of the dubious one star states is confirmed Significant SU(3) breaking is observed in some amplitudes.

38782 **(UM-P—83/63) Fresh look at D$\rightarrow$Kπ decays.** Eilam, G.; Scadron, M.D.; McKellar, B.H.J. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702544.

It is predicted that GAMMA($D^0 \rightarrow K^- \pi +$)/GAMMA($D^+ \rightarrow$(anti K)$^0 \pi^+$) is approximately 9/4 and GAMMA($D^0 \rightarrow$(anti K)$^0 \pi^0$)/GAMMA($D^0 \rightarrow K^- \pi^+$) is approximately 1/18. All values are without quantum chromodynamics corrections. It is argued that these are probably unimportant for two-body D decays.

38783 **Spinorial relativistic rotator: The transformation from quasi-Newtonian to Minkowski coordinates.** Biedenharn, L.C.; Bohm, A.; Tarlini, M.; van Dam, H.; Mukunda, N. (Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712). *Physical Review [Section] D: Particles and Fields;* **30**: No. 2, 409-420(15 Jul 1984). Contract AS05-76ER03992.

There exists a remarkably close relationship between the operator algebra of the Dirac equation and the corresponding operators of the spinorial relativistic rotator (an indecomposable object lying on a mass-spin Regge trajectory). The analog of the Foldy-Wouthuysen transformation (more generally, the transformation between quasi-Newtonian and Minkowski coordinates) is constructed and explicit results are discussed for the spin and position operators. Zitterbewegung is shown to exist for a system having only positive energies.

38784 **Dimension five interactions, fermion masses and Higgs mediated proton decay in SU(5).** Panagiotakopoulos, C.; Shafi, Q. (The Rockefeller University, New York, New York 10021). *Physical Review Letters;* **52**: No. 26, 2336-2339(25 Jun 1984). Contract AC02-78ER05007.

By supplementing the standard SU(5) Lagrangian with non-renormalizable (dimension five) terms which are needed in any case to obtain acceptable masses for the first two fermion generations, the proton decay predictions can be neatly reconciled with the ongoing experiments. We present a class of such models in which the dominant decay mode of the proton is $\mu^+ K^0$. A triplet of colored Higgs bosons of mass $\sim 10^{12}$ GeV, required for successfully implementing the inflationary scenario, mediate this and other decays.

38785 **Power-suppressed contributions to deep-inelastic processes.** Gunion, J.F.; Nason, P.; Blankenbecler, R. (Department of Physics, University of California, Davis, California 95616). *Physical Review [Section] D: Particles and Fields;* **29**: No. 11, 2491-2511(1 Jun 1984). Contract AC03-76SF00515;AM03-76SF00034.

We present results of a direct calculation of leading power-law corrections to the proton and pion structure functions at large x to order $1/Q^4$ for νW_2/sup proton/ and $1/Q^2$ for W/sub L//sup proton/ and to order $1/Q^2$ for νW_2/sup pion/ and W/sub L//sup pion/. For νW_2 we find large $\sim(1-x)^4$ corrections to the leading $\sim(1-x)^3$ behavior as x$\rightarrow$1 and substantial $(1-x)^3/Q^2$ corrections, a phenomenologically desirable form. We find a very large value for the coefficient of $1/Q^2$ in (σ/sub L//σ/sub T/)/sup proton/. The $1/Q^2$ correction to νW_2/sup pion/ is of the form proposed by Berger and Brodsky but much smaller than their estimate after complete normalization constraints are imposed. In addition, this correction is not purely longitudinal until (1-x) is very near zero.

38786 **Two-gluino bound states.** Keung, W.; Khare, A. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **29**: No. 11, 2657-2659(1 Jun 1984). Contract AC02-76CH00016.

We estimate the branching ratio and argue that two-gluino bound states can be detected in $Y \rightarrow y +$ $^1S_0$(gg) if m/sub g/$<$4.5 GeV. The signal would be comparable to the backgrounds in magnitude. In the case of top-quarkonium decay, the signal could be much enhanced due to the exchange of a possibly light scalar top quark. We also show that two-gluino bound states can exist only in $^1S_0$, ^3P/sub 0,1,2/, $^1D_2$, ^3F/sub 2,3,4/,..., but not in $^3S_1$, $^1P_1$, ^3D/sub 1,2,3/, $^1F_3$,. . . states. The decay width of the gg ground state is calculated. Finally, we discuss the gg potential.

38787 **Proton stopping power of heavy nuclei.** Csernai, L.P.; Kapusta, J.I. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review [Section] D: Particles and Fields;* **29**: No. 11, 2664-2665(1 Jun 1984). Contract AC02-79ER10364.

Inclusive cross sections for the reactions p+A$\rightarrow$p+X at 100 GeV are discussed in the framework of the evolution model proposed by Hwa. An exact solution to the evolution equation is found. A momentum-degradation length of 4.9 fm is inferred from the data.

38788 **Σ hypernuclei.** Dover, C.B.; Gal, A. (Brookhaven National Lab., Upton, NY). *Comments on Nuclear and Particle Physics;* **12**: No. 4, 155-165(Mar 1984).

Recently, Σ-hypernuclear levels of surprisingly narrow widths have been observed. The data is summarized and mechanisms discussed which lead to such quasistable Σ configurations.

38789 **Heavy quarks in hadronic collisions.** Brodsky, S.J.; Peterson, C. (Inst. for Advanced Study Princeton, NJ 08540). pp 363-393 of The search for charm, beauty, and truth at high energies. Vol. 16. Bellini, G.; Ting, S.C.C. New York, NY; Plenum Publishing Corp. (1984). (CONF-811195—). Contract AC03-76SF00515.

From Europhysics conference on the search for charm, beauty and truth at high energy; Erice, Italy (15 Nov 1981).

This chapter reviews the theoretical expectations for heavy quark production starting with estimates for "soft" production mechanisms and then elaborating on what is expected from perturbative QCD with regard to open heavy flavor production. Comparisons with experimental data on cc^- are provided. A general discussion of higher Fock state decomposition of hadronic states is given, and an argument is made for the existence of $|uuddcc^->$ of the 1% level. A model is presented for the c(x) distributions. Hadronic production of charm is considered. The model for c(x) is analyzed using data from leptoproduction experiments. It is concluded that a valencelike charm quark distribution c(x) in the nucleon at the 1% level accounts qualitatively for hadron induced charm production in magnitude, shape and diffractive features at ISR energies.

38790 **Question of baryon conservation.** Goldhaber, M. (Brookhaven National Lab., Upton, NY (USA)). pp 29-31 of Neutron and its applications, 1982. Plenary and invited papers from the conference to mark the 50th anniversary of the discovery of the neutron held at Cambridge, 13-17 September 1982. Schofield, P. (ed.). Bristol, England; Institute of Physics (1983). (CONF-820950—).

From Conference on the neutron and its applications; Cambridge, UK (13 Sep 1982).

A modern version of the law of baryon conservation might read: the net number of baryons (ΣB-ΣB-bar) does not change spontaneously or in any known interactions. For a long time it was believed that protons are absolutely stable, and neutrons sufficiently strongly bound by nuclei were also considered absolutely stable. Then a few years ago the grand unified theories were proposed in which strong, weak and electromagnetic interactions are combined, leading to the possibility that protons decay. Their lifetime is predictable in some of these theories. An experiment by the Irvine-Michigan-Brookhaven Collaboration to detect proton decays is described.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 64530038792, 38798

38791 **(JINR—E-2-83-126) Neutrino oscillations with large oscillation length in spite of large (Majorana) neutrino masses.** Bilenky, S.M.; Pontecorvo, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702540.

A model is given in which neutrino oscillations with two Majorana mass eigenstates are entirely similar to $K^o \rightarrow$anti K^o oscillations: an oscillation amplitude is a maximum one if a mass difference (m_1-m_2) is much less than m_1, m_2, PC parities of the Majorana neutrinos are equal to opposite values. It is plausible that a realistic situation with more than two Maro Majorana neutrino could well have similar features.

6454 Field Theory

REFER ALSO TO CITATION(S) 64540038665, 38765, 38804

38792 **(DOE/ER/70004—382) Particle physics. Annual report.** Moravcsik, M.J. (Oregon Univ., Eugene (USA). Inst. of Theoretical Science). 1984. Contract AT06-76ER70004. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013834.

Portions are illegible in microfiche products.

Accomplishments are briefly summarized in these areas: proton fragmentation in deep inelastic scattering, heavy ion collisions, factorization in the Drell-Yan process, looking for glueballs in heavy quarkonia decays, electric dipole moment of the neutron in a Higgs exchange model of CP nonconservation, left-right symmetry and CP violation, breaking of SU(5) supergravity, strong magnetic field in broken gauge theories, the polarization structure of particle reactions, x-ray laser pumped by radiation from storage rings, superfine x-ray gratings, and novel mechanisms of particle acceleration. Also summarized are papers on the uniqueness of supersymmetry for cancellation of quadratic divergencies, CP violation through Higgs exchange. Publications are listed. (LEW)

38793 **Cosmic separation of phases.** Witten, E. (Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review [Section] D: Particles and Fields;* **30**: No. 2, 272-285(15 Jul 1984). Contract AC02-76ER02220.

A first-order QCD phase transition that occurred reversibly in the early universe would lead to a surprisingly rich cosmological scenario. Although observable consequences would not necessarily survive, it is at least conceivable that the phase transition would concentrate most of the quark excess in dense, invisible quark nuggets, providing an explanation for the dark matter in terms of QCD effects only. This possibility is viable only if quark matter has energy per baryon less than 938 MeV. Two related issues are considered in appendices: the possibility that neutron stars generate a quark-matter component of cosmic rays, and the possibility that the QCD phase transition may have produced a detectable gravitational signal.

38794 **Generalized reflection positivity and modified Migdal-Kadanoff procedure for lattice gauge theories.** Tan, C.; Xu, Z. (Department of Physics, Brown University, Providence, Rhode Island 02912 and Laboratoire de Physique Theorique et Haute Energies, Orsay, France). *Physical Review [Section] D: Particles and Fields;* **30**: No. 2, 455-458(15 Jul 1984). Contract AC02-76ER03130.

The strict requirement of reflection positivity for lattice gauge theories is replaced by that of generalized reflection positivity with an integral period. A wide class of lattice gauge theories of interest are shown to possess reflection positivity with period two. For these systems, Hermitian positive Hamiltonians can be constructed, and a modified Migdal-Kadanoff procedure is introduced. The improved procedure is tested against the Z_4 lattice gauge theory where the phase diagram is known from Monte Carlo studies.

38795 **Field-strength formulation of classical dynamics for spherically symmetric non-Abelian systems.** Ralston, J.P.; Sivers, D. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] D: Particles and Fields;* **30**: No. 2, 472-482(15 Jul 1984). Contract W-31-109-ENG-38.

We employ the conditions of spherical symmetry to study the field equations for a classical SU_2 gauge theory coupled to specified currents. To emphasize the overlap with classical electrodynamics we create a field-strength formulation employing electric and magnetic non-Abelian fields as dynamic variables. We find that the covariant field equations which are the non-Abelian generalizations of Maxwell's equations can be simplified by using gauge-invariant projections. These projections allow the residual gauge variables to be removed from the formalism and replaced by the topological current. We eliminate transverse degrees of freedom and find that the topological charge E/sub i//sup a/B/sub i//sup a/, along with the Euclidean density E/sub i//sup a/E/sub i//sup a/ +B/sub i//sup a/B/sub i//sup a/, constitute nonlinear source terms in wave equations for radial projections of G/sub munu//sup a/. The ready comparison with electrodynamics allowed by the field-strength approach clarifies several dynamical issues.

38796 **Gauge dependence and the gravitational effective action.** Cohler, E.; Chodos, A. (J. W. Gibbs Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review [Section] D: Particles and Fields;* **30**: No. 2, 492-494(15 Jul 1984). Contract AC02-76ER03075.

The effective action in a gauge theory is in general gauge dependent. In this paper sufficient conditions are derived under which the effective action is the same in a wide class of gauges at the one-loop order.

38797 **Pure gauge SU(3) lattice theory on an array of computers.** Brooks, E. III; Fox, G.; Johnson, M.; Otto, S.; Stolorz, P.; Athas, W.; DeBenedictis, E.; Faucette, R.; Seitz, C.; Stack, J. (High Energy Physics Department, California Institute of Technology, Pasadena, California 91125). *Physical Review Letters;* **52**: No. 26, 2324-2327(25 Jun 1984). Contract AC03-81ER40050.

We report on a pure gauge SU(3) lattice theory computation performed on an array of 64 microprocessors interconnected as a 2^6 hypercube and having the cumulative power of approximately eight VAX11/780's. The availability of a substantial number of computer cycles, coupled with an improvement in the algorithm, made possible a high-statistics determination of the heavy-quark potential on a $12^3 \times 16$ lattice.

38798 **Absence of chiral symmetry breaking at high temperatures.** Tomboulis, E.T.; Yaffe, L.G. (Physics Department, University of California, Los Angeles, California 90024). *Physical Review Letters;* **52**: No. 24, 2115-2117(11 Jun 1984). Contract AC02-76ER03072.

The absence of chiral symmetry breaking for sufficiently high temperature (or chemical potential) is rigorously demonstrated in SU(2) lattice gauge theories with massless fermions in any number of dimensions.

38799 **Lattice THETA vacua.** Bhanot, G.; Seiberg, N.; Rabinovici, E.; Woit, P. (Princeton Univ., NJ). *Nuclear Physics* [*Section*] *B;* **230**: No. 3, 291-298(26 Mar 1984).

We study some aspects of THETA vacua by Monte-Carlo simulations of the SU(2) lattice gauge theory using a definition proposed recently for the total lattice topological charge. We find no phase transition up to THETA $= 0.8\,\pi$. Beyond this point, limited statistical accuracy prevents a definite conclusion. Our results are in surprisingly good agreement with the dilute gas picture.

38800 **Perturbative corrections to Migdal-Kadanoff recursion relations for Z_4 theory.** Roberts, L.E. (Brookhaven National Lab., Upton, NY). *Nuclear Physics* [*Section*] *B;* **230**: No. 3, 385-406(26 Mar 1984).

For the Z_4 lattice gauge theory in four dimensions or the associated spin system in two dimensions we examine the critical structure by making a correction to the bond-shifting operator. This is done for the most general single plaquette or nearest neighbor action. The two-dimensional problem in coupling space becomes a four-dimensional problem when the correction is made to the bond-shifting operators. The four-dimensional problem is decomposed into two two-dimensional problems which allows for the effective application of the Migdal-Kadanoff recursion relations in differential form. The solutions to the two-dimensional problems are then recomposed into the solution of the original two-dimensional problem in coupling space. Of particular interest is the region $\beta_2 < 0$, $\beta_1 >= 0$, where β_1 and β_2 are the coupling constants in the fundamental and adjoint representations respectively. We find a critical structure, including a second crossover, which leads to a splitting of the phase structure in this region which is in agreement with Monte Carlo predictions.

38801 **Soliton with valence quarks in the chiral invariant sigma-model.** Kahana, S.; Ripka, G.; Soni, V. (CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). *Nuclear Physics* [*Section*] *A;* **415**: No. 3, 351-364(19 Mar 1984).

The chiral invariant sigma-model is used to obtain bound states (solitons) of valence quarks. A hedgehog shape is assumed for the pion field. A soluble model is presented and compared to a self-consistent calculation. The results are discussed in the light of the possible effective baryon number carried by the chiral fields.

38802 **Nonpertubative weak-coupling analysis of the quantum Liouville field theory.** Braaten, E.; Curtright, T.; Ghandour, G.; Thorn, C. (Physics Department, University of Florida, Gainesville, Florida 32611). *Annals of Physics (New York);* **153**: No. 1, 147-203(Mar 1984). Contract AS05-81ER40008.

Two independent weak-coupling expansions are developed for the Liouville quantum field theory in a circle. In the first, the coupling of the nonzero modes is treated as a perturbation on the exact solution to the zero-mode problem (quantum mechanics with an exponential potential). The second approach is a weak coupling approximation to an explicit operator solution which expresses various Liouville operators as functions of a free massless field using a Baecklund transformation. It is shown that the free state space associated with the latter solution must be restricted to the sector which is odd with respect to a type of "parity." Various matrix elements are computed to order g^{10} using both approaches, yielding identical results.

38803 **Discovery of glueballs.** Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY). *Surveys in High Energy Physics;* **4**: No. 1-2, 69-126(Jul 1983).

Quantum Chromodynamics and other modern theories are based on local gauge invariance of SU(3)sub(color). There are eight resultant gauge bosons with color called gluons which bind the quarks together into hadrons. However they self interact strongly at low energies and necessarily should form 'glueballs' (multi-gluon resonant states). This paper describes the discovery of one or two glueballs by the BNL/CCNY collaboration in the OZI suppressed $\pi^- p \rightarrow$ phiphin. The discovery conclusion is based on the correctness of modern Quantum Chromodynamics practice. This is a great triumph for Quantum Chromodynamics and other modern theories based on local gauge invariance of SU(3)sub(color). 43 references.

6455 Scattering Theory

38804 **(DOE/ER/03227—78) Theory of high energy collision processes. Final report, June 1, 1969-May 31, 1984.** Wu, T.T. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). 31 May 1984. Contract AC02-76ER03227. 22p. (COO—3227-78). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013476.

We have developed a comprehensive theory for scattering processes at extremely high energies. On the basis of relativistic quantum field theories with or without isotopic spin, we have obtained a simple physical picture, called the impact picture, which gives a number of unusual predictions. Many of these have been verified experimentally, including the increasing total cross sections, the increasing total elastic cross sections, the moving dip, and the rising plateau. An especially accurate experimental verification of the prediction of increasing total cross section has been provided by the CERN p anti p Collider at a c.m. energy of 540 GeV. All of these predictions were obtained by resumming the perturbation series. The natural next step is to look for important physical effects that cannot be seen by any method of resumming the perturbation series. One such method is to find nonperturbative effects already present on the classical level; another is to construct exactly solvable models of quantum field theory. Both approaches have been pursued. Recent theoretical results include the possible occurrence of indeterminate-mass particles, dynamic determination of coupling constants, a solvable Z_6 lattice gauge theory, a generalization of the method of helicity amplitudes, classical models of confinement, and a monopole as a short-distance probe. 152 publications are listed.

38805 **Algebraic approach to the scattering matrix.** Alhassid, Y.; Engel, J.; Wu, J. (A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review Letters;* **53**: No. 1, 17-20(2 Jul 1984). Contract AC02-76ER03074.

A purely algebraic procedure is presented for calculating recursion relations for S matrices belonging to problems associated with the group SU(1,1). The procedure involves supplementing a recently introduced group-theoretic approach to scattering by an algebraic framework that characterizes asymptotic behavior. Our formulation makes use of the Euclidean group, which contains the symmetry transformations for a free particle. The Coulomb and Poeschl-Teller potentials are discussed to illustrate our methods.

38806 **Monte Carlo method for the many-body scattering problem.** Alhassid, Y.; Koonin, S.E. (Institute for Theoretical Physics, University of California, Santa Barbara, California 93106). *Annals of Physics (New York);* **155**: No. 1, 108-132(Jun 1984). Contract AC02-76ER03074.

The non-relativistic many-body scattering problem is cast in a form suitable for treatment by Monte Carlo methods. The formulation is based on resonant standing waves of the compound system, similar to those used in the R-matrix theory of nuclear reactions. Integral expressions are derived from which the scattering matrix elements at low energies can be evaluated. The method is demonstrated by application to simple one- and two-channel one-dimensional scattering problem.

65 PHYSICS. II.

6510 Nuclear Physics

38807 **(DOE/ER/03244—105) Experimental medium energy physics. Annual progress report, June 1983-May 1984.** (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). 1984. Contract AC02-76ER03244. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014625.

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During the past year the principal activities of the C-MU Medium Energy Physics Group have included running of previously approved experiments, the development of hardware and software for new experiments, continued analysis of previously accumulated data, and the development of model calculations to be compared with these data. Major data runs have taken place on a hypernuclear experiment (AGS 781) at the AGS, and on an antiproton run at CERN/LEAR (PS-185). In addition, planning is continuing for further hypernuclear lifetime measurements in ^{4} ^{5}He, and for a possible search for the H-particle. For these experiments extensive hardware and software development has taken place, requiring much of the group's effort. In our ongoing studies of the pion annihilation mechanism, the emphasis has shifted from two-body processes to those involving three-body final states. A large effort is being devoted to the analysis of our (π,xy) data accumulated at LAMPF on targets of ^{6} ^{7}Li, ^{14}N, ^{16}O and CD_2. During the year considerable effort was devoted to Monte Carlo simulations of the rare weak decay $K^+ \rightarrow \pi^+$ nu anti nu; this experiment has been approved as AGS 787. In addition, work has continued on the development of model calculations of the (π,pp) and anti pp $\rightarrow$ anti $\Lambda\Lambda$ reactions. (WHK)

38808 **(INIS-SU—236) Physics of atomic nuclei and elementary particles. Part 3.** (AN SSSR, Moscow; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. 237p. (In Russian). (CONF-8210210—Pt.3). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474.

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

38809 **(KFK—3621) Annual report on nuclear physics activities from July 1, 1982 - June 30, 1983.** Gemmeke, H.; Kaeppeler, F.; Weddigen, C. (eds.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Nov 1983. 230p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780151.

Separate entries were made in the data base for the sections included. (WHK)

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 65110038100, 38306

38810 **(BNL—34952) Event parameters - fixed target.** Poskanzer, A.; Ritter, H.G.; Ludewigt, B.; Foley, K.; Borenstein, S.; Platner, E.; Love, W.; Keane, D.; Plasil, F. (Brookhaven National Lab., Upton, NY (USA); Lawrence Berkeley Lab., CA (USA); Oak Ridge National Lab., TN (USA); California Univ., Riverside (USA)). 15 Jun 1984. Contract AC02-76CH00016. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014817.

This subgroup has focussed on detectors for fixed target experiments which have full azimuthal coverage. The general scope of the working group was to consider (1) the configuration of an idealized detector, and (2) various configurations of practical detectors that could be implemented on a relatively short time scale. The second category includes possible upgrades and modifications of existing experimental facilities. Beams of both 15 GeV/A sulphur at the AGS and 200 GeV/A oxygen at the SPS were considered.

38811 (INIS-SU—236, pp 110-113) **Collaboration of Czechoslovakia and JINR, Dubna, in the SPIN program.** Yakiot, Z.; Malinski, P. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)); Finhger, M. (Karlova Univ., Prague (Czechoslovakia)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Experimental facility is described for the study of the decay of oriented nuclei in a broad range of Z, A and half-lives based on hyperfine interaction at ultralow temperatures. Nuclear orientation is performed by internal magnetic field for a ferromagnetic host saturated by an external field of a superconducting magnet. The angular distribution of gamma-rays from decay of terbium nuclei oriented in a gadolinium host has been studied.

38812 **(JINR—10-83-276) Organization of relativistic nuclear physics experiments on-line with the ES-1040 computer.** Bazylev, S.N.; Efimov, L.G.; Kolpakov, I.F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701608.

Hardware and software of the ES-1040 computer used for on-line experiments are considered. Electronics for connecting the ES-1040 computer with the experimental installation and data acquisition software are described. The general-system hardware and software providing the additional capabilities during experimental research are described. The perspectives of experimental means development are shown. These are means for organization of simultaneous data acquisition from several installations and devices for graphical and alphanumerical data output. Main advantages of the ES-1040 computer as compared with mini-computers in organization of their operation on-line with spectrometers are formulated.

38813 **(JINR—10-83-362) Pulse-burst generator unit with programmable parameters.** Rodionov, K.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1983. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701613.

Programmable pulse-burst generator is described. It is intended for forming the oscillating magnetic field in spin flipper of ultracold neutrons. The generator has 4 modes of selecting pulse series. The program controls the pulse recurrence, pulse-burst duration and dead time, initial phase pulse burst. The frequency range is 20-50000 Hz; pulse amplitude - 0-6 V; initial phase - 0, $+\pi/2$, $-\pi/2$. The unit is made in CAMAC standard.

6512 Nuclear Properties And Reactions, A=1-5

38814 (INIS-SU—236, pp 3-8) **Structure functions of deuteron on small distances.** Titov, Yu.I.; Esaulov, A.S.; Inopin, E.V.; Akhmerov, R.V.; Smelov, E.M. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Inelastic electron-deuteron scattering spectrum has been measured at a scattering angle of 70 deg. At the disintegration threshold, the squared 4-momentum transfer reaches a value of 1.8 $(GeV/c)^2$, which makes the data sensitive to the quark structure of the deuteron. The structural functions W_1 and W_2 have been separated, the ratio W_1/W_2 being 7.9+-2.5 near threshold.

38815 **(ITEP—114(1983)) Are there multiquark bags in nuclei.** Kondratyuk, L.A.; Scmatkov, M.Zh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702550.

Arguments are presented favouring the idea that multiquark bags do exist in nuclei. Such hypothesis makes possible to reveal the relationship among three different scopes of phenomena: deep inelastic scattering of leptons by nuclei, large q^2 (where q^2 is a

square of momentum transfer) behaviour of the form factors of light nuclei and yield of cumulative protons.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 65131038776

38816 **(INIS-mf—8390) Search for parity violation in the 1081 keV γ-transition of ^{18}F.** Grotz, K. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1981. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780258.

The effect of a parity violation in the atomic nucleus by neutral currents can be studied on ^{18}F. The theory predicts a circular polarization of the 1081 KeV γ transition of about 5per mille. In the framework of this thesis an improved poalrimeter for the measurement of the γ circular polarization was constructed. Furthermore an apparature containing 4 Ge(Li) detectors was extended by 4 NaI detectors. The circular polarization was determined to (-1.0 +- 1.8)per mille. (orig.).

38817 (INIS-SU—236, pp 42-46) **Low-energy theorems for pion photoproduction on nuclei and the constants of pion-nuclear interaction.** Radutskij, G.M.; Serdyutskij, V.A. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The new low-energy theorems are established for the pion photoproduction on light nuclei in the model based on the current algebra, CVC and PCAC. They enable one to extract pion-nuclear interaction constants and to predict electric quadrupole moment of the ground state of the nucleus ^{12}N from experimental data on the total cross sections of the charged pion photoproduction on ^{6}Li, ^{12}C and ^{14}N at threshold.

38818 (INIS-SU—236, pp 18-21) **Study on the decay characteristics of photonuclear reactions.** Ishkhanov, B.S.; Kapitonov, I.M. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The experimental results on the decay characteristics of the giant dipole resonance for the light nuclei (A=12-40) are presented. From an analysis of both the photoproton cross sections with production of the final nucleus in various states and the pickup experimental data the contribution of semidirect processes to the giant dipole resonance and the magnitude of its configurational splitting are deduced.

38819 (INIS-SU—236, pp 27-31) **Excitation of light nuclei by pions and protons with intermediate energies.** Kirpichnikov, I.V.; Kuznetsov, V.A.; Levintov, I.I.; Starostin, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The characteristic gamma-radiation from the excited states of ^{12}C(2$^+$, 4.43 MeV), ^{16}O(3$^-$, 6.13 MeV), and ^{40}Ca(3$^-$, 3.74 MeV) were measured in coincidence with scattered high energy pions and protons. The polarization of the excited nuclei and the excitation cross-sections were measured.

38820 (INIS-SU—236, pp 32-36) **Study on the correlation effects in the carbon photodisintegration reactions with yield of np pairs.** Dogyust, I.V.; Voloshchuk, V.I.; Kirichenko, V.V.; Khodyachikh, A.F. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The method which makes use of the diffusion chamber in the magnetic field has been applied to measure total and differential cross sections, distributions of the relative energy of the C(γ, pn)B and C(γ, pn)αLi reactions. The results confirm qualitatively the validity of the quasi-deuteron model.

38821 (INIS-SU—236, pp 37-41) **Quasi-free scattering of electrons on the ^{12}C nucleus at large momentum transfers.** Akhmerov, R.V.; Esaulov, A.S.; Inopin, E.V.; Korchin, A.Yu.; Smelov, E.M.; Titov, Yu.I.; Shebeko, A.V. 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Spectrum of inelastic electron scattering on ^{12}C nucleus has been measured at an initial energy of 1.45 GeV and a scattering angle of 70 deg. The quasi-free peak is well described in the interaction-time approximation with a Reid softcore potential.

38822 **(JINR—E-4-83-574) Cross sections of the sup(12)C(γ,πsup(+))sup(12)B(1sup(+)sub(g.s.), 2sub(1)sup(+)) reaction.** Eramzhyan, R.A.; Gmitro, M.; Kaipov, T.D.; Kamalov, S.S.; Mach, R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702551.

The pion photoproduction on ^{12}C into the lowest isovector 1$^+$ and 2$^+$ levels of ^{12}B is calculated. Nuclear transition densities used here have been extracted from (e, e') data; those for the E2 transition, using the Siegert method. The consistency with the electromagnetic data has allowed to reach an improvement in several instances over the earlier results; the calculations agree with experimental data. The assumption of an on-shell pion propagation in nuclei allows to remove a discrepancy in the differential cross section (1.5-2 times) at small angles for the transition to the 1$^+$ state. In the case of transition to the 2$^+$ state a large difference between the shell- and Helm-model calculations (3 to 4 times) is accounted for.

38823 (LA—9933-C-Vol.2, pp 809-810) **Classical Nuclear Physics Working Group.** Gibbs, W.R. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The session was divided into two sections: proposals for new experiments and presentations of new results and specific discussion of beam lines. The first section included discussions of proton, kaon plus and pion reactions possible at LAMPF II. In the second section results of kaon plus elastic scattering calculations and proposals for energetic beam lines were discussed.

38824 **(UM-P—83/59) Particle-hole description of GDR states in light nuclei with closed shells +- 2 nucleons.** Assafiri, Y.I.; Morrison, I. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702552.

The particle-hole model is presented for nuclei with closed core +- 2 nucleons. The model, as applied to ^{6}Li, ^{14}N, ^{14}C and ^{18}O, gives overall agreement with experiment for the low-lying and GDR states.

38825 **(UM-P—83/66) Analytic distorted wave approximation for kaon-nucleus interactions.** Amos, K.; Di Marzio, F. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702555.

At 800 MeV/c momentum, with optical potentials defined from K-nucleon phase shifts, distortion effects in the K-nucleus wave function can be approximated by a simple form that may be useful in analyses of more complicated kaon induced nuclear reactions.

38826 (UM-P—83/72) Alpha cluster model and spectrum of ^{16}O. Bauhoff, W.; Schultheis, H.; Schultheis, R. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84702553.

The structure of ^{16}O is studied in the alpha cluster model with parity and angular-momentum projection for several nucleon-nucleon interactions. The method differs from previous studies in that the states of positive and negative parity are determined without the customary restriction of the variational space to cluster positions with certain assumed symmetries. It is demonstrated that the alpha cluster model of ^{16}O is capable of explaining most of the experimental T = O levels up to about 15 MeV excitation. A shell-model analysis of the excited cluster-model states shows the necessity of including a very large number of shells. The evidence for the recently proposed tetrahedral symmetry of some excited states is also discussed.

38827 (UM-P—83/75) Channel coupling and distortion effects in the excitation of the 0_2i state in ^{12}C by alpha scattering. Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702554.

The excitation of the 0_2^+ (7.65 MeV) state in ^{12}C by inelastic alpha scattering is investigated using microscopic resonating-group wave-functions in a coupled channel folding model. The importance of coupling to other states and the influence of varying the optical potential in the excited states is studied. Both effects must be taken into account for a quantitative description.

38828 Electric spin resonances in light nuclei. Castel, B.; Hees, A.G.M. van; Zamick, L. (Oak Ridge National Lab., TN). *Nuclear Physics [Section] A;* **415**: No. 1, 30-36(5 Mar 1984).

Very recent point inelastic scattering experiments at LAMPF have revealed the existence of strong spin-flip E1 resonances in the vicinity of the GDR in several light nuclei. We present here the results of shell-model calculations of S=0 and S=1 E1 strength distributions which offer a broad theoretical context for the discussion of electric spin excitations. Our results for ^{16}O and ^{40}Ca corroborate the LAMPF data and indicate that a major fraction of the spin-flip strength still lies above the GDR.

6514 Nuclear Properties And Reactions, A=20-38

38829 (INIS-mf—8718) Study of the γ- and particle decay of high spin states in ^{27}Al. Weidl, I. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 31 Jan 1983. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780259.

In the reaction ^{16}O + ^{12}C highly excited states in ^{27}Al are very selectively populated by emission of a proton, which has to be attributed to the high spin of these states. For these high spin levels excitation functions at incident energies Esub(cm) = 18.7-30.1 MeV were measured with a step width of 150 keV. The heavy residual nuclei can be uniquely identified according to charge and mass number in the recoil spectrometer. Therefore it succeeded to determine for the γ- and particle decays of the high spin states in ^{27}Al the branching ratios. The found states in ^{27}Al at Esub(x) = 14.87, 15.75, 16.05, and 19.52 MeV come in question as Yrast levels with the mostly probable spins $21/2^+$, $19/2^+$, $23/2^+$, and $27/2^+$. To the levels at 16.77 and 17.35 MeV each a spin of $21/2^+$ is assigned. The neutron emission must then in some case take place with an orbital angular momentum L = 6, from which by means of the Nilsson Model an increasing deformation for the highly excited levels can be derived. Especially for the state populated strongly in the 14^+ resonance et Esub(cm) = 19.7 MeV a deformation similar to that one of a nuclear molecule results from the comparison with the likely analogous state at 15.45 MeV in the minor nucleus ^{27}Si. Also in the further decay of a $(23/2)^+$ state at 18.54 MeV which takes place exclusively via the n-channel, the influence of structure effects becomes clearly visible. (orig./HSI).

38830 (INIS-mf—8970) Levels in ^{23}Na excited by the ^{19}F(α,α)^{19}F, ^{19}F(α,γ)^{23}Na and ^{19}F(α,p)^{22}Ne reactions. Cseh, J.; Koltay, E.; Mate, Z.; Somorjai, E.; Zolnai, L. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780476.

Excitation functions have been measured at five angles for ^{19}F(α,α)^{19}F scattering process up to Esub(α)=3.7 MeV. The yield curves for the ^{19}F(α,γ)^{23}Na, ^{19}F(α,psub(0))^{22}Ne and ^{19}F(α,psub(1)γ)^{22}Ne reactions were also obtained in simultaneous measurements. Multi-level R-Matrix calculation was used to analyse the elastic scattering data yielding parameters for 16 resonances. Sixty resonances corresponding to levels in ^{23}Na were seen in the different reactions. A comparison of resonance energy and total width data is given. The ^{19}F(α,γ)^{23}Na reaction below Esub(α)=2.3 MeV was studied also with thick target measurements. Decay schemes are given for two resonances. The α-particle strength is discussed (author).

38831 (UM-P—83/48) Photoneutron cross section of ^{34}S. Assafiri, Y.I.; Egan, G.F.; Thompson, M.N. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702556.

Using an enriched ^{34}S target, the reaction ^{34}S(γ,sn)^{33}S has been measured from below threshold (10.4 MeV) to 28 MeV by directly counting the photoneutrons as a function of bremsstrahlung energy. The resultant cross section shows gross splitting in the GDR region. The integrated cross section is discussed in the light of the systematics of similar nuclei having two neutrons outside a doubly closed shell/sub-shell core.

38832 (UM-P—84/2) Highly excited states of ^{27}Si populated in the ^{24}Mg(^{10}B,^{7}Li)^{27}Si reaction. Andrews, P.R.; Shute, G.G.; Collins, S.F.; Spicer, B.M.; Atwood, C.H.; Ophel, T.R. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702557.

Differential cross sections were obtained for ^{7}Li-groups emitted in the ^{24}Mg(^{10}B,^{7}Li)^{27}Si reaction at 81 MeV. Final states with excitation energies up to 14 MeV were observed. DWBA calculations enabled spin-parity assignments to be made to states at 6.32 MeV ($9/2^+$), 11.3 MeV ($9/2^+$ or $13/2^+$) and 11.7 MeV ($13/2^-$).

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 65151038828, 38874

38833 (FRNC-TH—1454) Study of elastic and inelastic scattering of ^{12}C on ^{40}Ca and ^{48}Ca. Le Metayer, C. (Paris-11 Univ., 91 - Orsay (France)). Jun 1982. 87p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84751588.

Angular distributions in elastic and inelastic scattering of ^{12}C on ^{40}Ca and ^{48}Ca at 34.6 MeV (c.m.) were measured. The experimental results are presented and discussed using the optical model and the semi-classical analysis.

6516 Nuclear Properties And Reactions, A=59-89

38834 (ZfK—503, pp 22) Negative parity states in doubly-odd Br nuclei. Doering, J.; Winter, G.; Fromm, W.D.; Funke, L.; Kemnitz, P.; Will, E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

In Joint annual report 1982.

38835 (ZfK—503, pp 23) **Evidence for strong deformation in ^{83}Kr in connection with three-quasiparticle bands.** Kemnitz, P.; Doering, J.; Funke, L.; Winter, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Hildingsson, L.; Jerrestam, D.; Johnson, A.; Lindblad, T. (Radiofysiska Institutionen, Stockholm (Sweden)). Jun 1983. NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

In Joint annual report 1982.

38836 **Momentum transfer in the fragmentation of copper by 400-GeV protons.** Cumming, J.B. (Brookhaven National Lab., Upton, NY). *Canadian Journal of Chemistry;* **61**: No. 4, 697-700(Apr 1983).

Mean momenta transferred to products of the fragmentation of copper by 400-GeV protons have been determined by the thick-target thick-catcher technique. Comparison with data for incident protons and heavy ions indicates that the limiting fragmentation region has been reached and supports a simple relationship between momentum and energy transfers in peripheral reactions which had been proposed previously.

6517 Nuclear Properties And Reactions, A=90-149

38837 **(BNL—34940) Studies of neutron-rich nuclei far from stability at TRISTAN.** Gill, R.L. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 11p. (CONF-8406149—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014698.

From TRIUMF-ISOL workshop; Montreal, Canada (13 Jun 1984).

Portions are illegible in microfiche products.

The ISOL facility, TRISTAN, is a user facility located at Brookhaven National Laboratory's High Flux Beam Reactor. Short-lived, neutron-rich nuclei, far from stability, are produced by thermal neutron fission of ^{235}U. An extensive array of experimental end stations are available for nuclear structure studies. These studies are augmented by a variety of long-lived ion sources suitable for use at a reactor facility. Some recent results at TRISTAN are presented as examples of using an ISOL facility to study series of nuclei, whereby an effective means of conducting nuclear structure investigations is available.

38838 (INIS-SU—198, pp 90) **New isomeric states of sup(131)Pr, sup(138)Pm, sup(146)Tb nuclides.** Ganbaatar, N.; Kormitski, Ya.; Mezilev, K.A.; Novikov, Yu.N.; Nurmukhamedov, A.M.; Potempa, A.; Senyavski, E.; Tarkani, F. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38839 (INIS-SU—198, pp 91) **Decay of Ce and La nuclides with A=132.** Vylov, Ts.; Zhelev, Zh.; Mikhajlova, M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38840 (INIS-SU—198, pp 93) **Sup(134)Ce(Tsub(1/2)=75.9 hours) decay.** Gromov, K.Ya.; Islamov, T.A.; Kalinnikov, V.G.; Lebedev, N.A.; Tangabaev, A.A.; Kholmatov, A.Kh.; Tsupko-Sitnikov, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38841 (INIS-SU—198, pp 95) **Angular distribution of gamma radiation from (n, n'γ) reaction on sup(135)Ba nuclei.** Bondarenko, V.A.; Kuvaga, I.L.; Prokof'ev, P.T.; Rezvaya, G.L.; Solomonova, T.L. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38842 (INIS-SU—198, pp 101) **Determination of a relative probability of K capture to the 1189.5 keV level of ^{146}Nd.** Begzhanov, R.B.; Azimov, K.Sh.; Mirakhmedov, Sh.A.; Magrupov, R.D.; Narzikulov, M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38843 (ZfK—503, pp 17) **Empiric model for calculating gamma spectra resulting from neutron-induced reactions.** Basarragtscha, D.; Hermsdorf, D.; Seeliger, D. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Jun 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

In Joint annual report 1982.

38844 (ZfK—503, pp 27-28) **Anomalous decoupled bands of negative parity in double even transitional nuclei with A approximately 100.** Kostov, L.K.; Andrejtscheff, W. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Rotter, H.; Prade, H.; Stary, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

In Joint annual report 1982.

38845 (ZfK—503, pp 31) **In-beam study of high-spin states in the even-mass N=82 nuclei ^{138}Ba and ^{140}Ce.** Enghardt, W.; Prade, H.; Kaeubler, L.; Keller, H.J.; Kotte, R.; Stary, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

In Joint annual report 1982.

38846 **Optical model of few-MeV neutron elastic scattering from Z = 39 to 51 targets.** Smith, A.B.; Guenther, P.T.; Whalen, J.F. (Argonne National Lab., IL). *Nuclear Physics [Section] A;* **415**: No. 1, 1-29(5 Mar 1984).

Neutron differential-elastic-scattering cross sections of elemental Y, Zr, Nb, Mo, Rh, Pd, Ag, Cd, In, Sn and Sb were measured from approx.=1.5 to 4 MeV, at intervals of <=100 keV, with resolutions of approx.=50 to 75 keV, and at ten or more scattering angles distributed between 20 and 160°. Complementary broad-resolution neutron total cross sections of elemental Y, Nb, Rh, Pd, In, Sn and Sb were measured from approx.=0.8 to 4.5 MeV at intervals of <=50 keV. The experimental results were interpreted within the framework of the spherical optical-statistical model (OM). A 'regional' OM parameter set, quantitatively describing the neutron-nucleus interaction in this mass-energy domain, was deduced from the observed cross sections. Characteristics of this 'regional' OM potential are discussed, particularly the geometric, isospin and shell-dependent properties. 59 references.

38847 **Decay of 56-s ^{148}Ce to levels of odd-odd ^{148}Pr.** Aras, N.K.; Chung, C.; Faller, S.; Stone, C.A.; Walters, W.B.; Gill, R.L.; Shmid, M.; Chrien, R.E. (Maryland Univ., College Park). *Canadian Journal of Chemistry;* **61**: No. 4, 780-785(Apr 1983).

The decay of ^{148}Ce to levels of ^{148}Pr has been studied using mass-separated sources. A half-life of 56 +- 1 s has been measured for the decay of ^{148}Ce. A level scheme containing 40 γ rays and 15

excited levels is proposed for ^{148}Pr. Strongly β-fed 1^+ levels have been identified at 390 and 520 keV that are similar in position to 1^+ levels observed in isotonic ^{146}La and isotopic ^{146}Pr.

38848 **Compilation of neutron precursor data.** Mann, F.M.; Schreiber, M.; Schenter, R.E. (Hanford Engineering Development Lab., Richland, WA (USA)); England, T.R. (Los Alamos National Lab., NM (USA)). pp 272-276 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Paper copy only, copy does not permit microfiche production4 refs.; 2 figs.; 6 tables.

Delayed neutron precursor data (yields and spectra) are being compiled in preparation of a new ENDF/B evaluation of delayed neutron data. Precursor Psub(n) values have been updated using ENDF/B-VM yields, ENDF/B-V decay data, and consensus Psub(n) values. Weighted averages of these Psub(n) values will be presented along with their effect on fission yields, Psub(n) systematics, and model code calculations.

6518 Nuclear Properties And Reactions, A=150-189

38849 (INIS-SU—198, pp 104) **Pure Gamow-Teller transitions $0^+ \rightarrow 1^+$ in Yb, Er, Dy nuclei decay.** Ganbaatar, N.; Gromov, K.Ya.; MezileV, K.A.; Novikov, Yu.N.; Nurmukhamedov, A.M.; Potempa, A.; Tarkani, F. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38850 (INIS-SU—198, pp 110) **Angular distributions of gamma quanta from the ^{150}Sm(n, nsup(')γγ) reaction.** Demidov, A.M.; Govor, L.I.; Cherepantsev, Yu.K. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38851 (INIS-SU—198, pp 111-112) **Nuclear alignment of TbGd isotopes and the analysis of even-even Gd nuclei by means of the interacting boson model.** Lipas, R.O.; Kumpulajnen, Ya.; Khammaren, E.; Khonkaranta, T.; Finger, M.; Kratsikova, T.I.; Prokhazka, I.; Ferentsei, J. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38852 (INIS-SU—198, pp 115) **New levels of ^{152}Eu excited in the (p,3n) reaction.** Prokof'ev, P.T.; Simonova, L.I.; Soramel, F.; Stychen', Ya.; Klejnkhejnts, P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38853 (INIS-SU—198, pp 117) **Beta-vibrational states in sup(153,155)Eu.** Bondarenko, V.A.; Kramer, N.D.; Prokof'ev, P.T.; Spits, A.Zh.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38854 (INIS-SU—198, pp 125) **De-excitation of super band levels in ^{160}Dy.** Grigor'ev, E.P.; Dadamukhamedov, T.D. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38855 (INIS-SU—198, pp 128-129) **Investigation of ^{161}Dy with the (d,p) and (d,t) reactions.** Balodis, M.K.; Hungerford, P.; Shmidt, H.H.; Egidy, T. von; Scheerer, H.J.; Chalupka, A.; Kerr, S.A. 1983. NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38856 (INIS-SU—198, pp 142) **Study of X radiation in the ^{173}Lu→^{173}Yb decay.** Sergienko, V.A.; Vorontsovskij, A.V.; Lebedev, P.P.; Naim, M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38857 (INIS-SU—198, pp 147) **Nuclear g factors and structure of isomeric 7sup(-) states in sup(186,188)Os and sup(196,198)Hg isotopes.** Gorbachev, B.I.; Levon, A.I.; Nemets, O.F.; Sevastyuk, O.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38858 (INIS-SU—198, pp 122) **Identification of boundary of nuclide proton stability.** Alkhazov, G.D.; Ganboatar, N.; Gromav, K.Ya.; Kalinnikov, V.G.; Mezilev, K.A.; Novikov, Yu.N.; Nurmukhamedov, A.M.; Potempa, A.; Tarkani, F. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38859 (INIS-SU—198, pp 146) **Determination of the intensity of some conversion lines associated with ^{184}Ta decay.** Bulgakov, V.V.; Gavrilyuk, V.I.; Lashko, A.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38860 **Neutron capture cross sections of tantalum from 2.6 to 1900 keV.** Macklin, R.L. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Science and Engineering;* **86**: No. 4, 362-371(Apr 1984).

Neutron capture by a tantalum sample was measured at the Oak Ridge Electron Linear Accelerator pulsed neutron time-of-flight facility on a 40-m flight path. Average cross sections for ^{181}Ta(n,γ) in the energy range from 2.6 to 1900 keV were derived. The partially resolved region from 2620 to 4000 eV was fitted in terms of resonance parameters by least-squares adjustment.

38861 **Signature inversion - a fingerprint of triaxiality.** Bengtsson, R.; Frisk, H.; May, F.R.; Pinston, J.A. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen, Denmark). *Nuclear Physics [Section] A;* **415**: No. 2, 189-214(12 Mar 1984).

With 32 refs.

Theoretical calculations show that the energetic signature splitting of the lowest high-j quasiparticle orbitals can be inverted compared to what is expected for purely prolate ($\gamma=0°$) or oblate ($\gamma=-60°$) rotational bands, if the nucleus has a triaxial shape with $-120° < \gamma < -60°$ or $0° < \gamma < 60°$. The signature inversion occurs only in certain frequency intervals and for certain positions of the Fermi surface, which can be predicted theoretically. A comparison with experimental data shows that signature inversion has been observed in the predicted regions. From the experimental signature splitting of the [i13/2]sub(n) [h11/2]sub(p) band in the N=89 and N=91 isotones of the rare-earth nuclei, we have deduced the most likely deformations. We find in all cases triaxial deformations with γ-values in the interval $5° < \gamma < 25°$.

38862 Analysis of n+165Ho and ^{169}Tm reactions. Young, P.G.; Arthur, E.D. (Los Alamos National Lab., NM (USA)); Philis, C.; Nagel, P.; Collin, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). pp 792-795 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Microfiche only, copy does not permit paper copy reproduction3 refs.; 5 figs.; 2 tables.

Experimental data for neutron-induced reactions on ^{165}Ho and ^{169}Tm have been theoretically analyzed in preparation for calculations on the unstable isotopes of Tm. A set of deformed optical model parameters was determined from measurements of s- and p-wave neutron strength functions, total cross sections, elastic angular distributions, and 16-MeV proton scattering to the ^{165}Ho ground and first excited states. The parameters for the ^{165}Ho and ^{169}Tm nuclei were linked by means of an isospin term in the real and imaginary well depths, together with adjustment of the β_2 and β_4 deformation parameters based on systematics in this mass region. Transmission coefficients from this analysis were used in Hauser-Feshbach statistical model calculations of the ^{169}Tm(n,γ) cross section as well as the ^{169}Tm(n,2n) and (n,3n) cross sections to 23 MeV, after application of suitable preequilibrium corrections. The results of these calculations are in good agreement with most of the available experimental data on ^{165}Ho and ^{169}Tm.

38863 ^{187}Os + n resonance parameters in the interval 27-500 eV neutron energies. Winters, R.R. (Denison Univ., Granville, OH (USA)); Carlton, R.F. (Middle Tennessee State Univ., Murfreesboro (USA)); Harvey, J.A.; Hill, N.W. (Oak Ridge National Lab., TN (USA)). pp 943-944 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

The neutron total cross section for ^{187}Os, in the energy range, 27 eV to 500 eV, has been measured at the ORELA facility by the neutron time-of-flight technique, utilizing a 2.0 gm Osmium sample (n = 0.008401 Os-nuclei/barn) enriched to 70.38% ^{187}Os. Measurements were performed at a 80 m flight station with an energy resolution, $\Delta E/E$, of 0.1% using a ^{6}Li glass scintillator. Resolved resonances have been analyzed by a Reich-Moore multilevel code (SAMMY) to obtain parameters for 85 resonances up to 500 eV. Preliminary determinations of the level spacing (5 eV) and s-wave strength function (3.9×10^{-4}) for ^{187}Os are in agreement with recent analyses of the osmium isotopes, made in connection with the use of the Re/Os chronometer for estimating the duration of stellar nucleosynthesis.

38864 Neutron capture cross sections of $^{178\ 179\ 180}$Hf and the origin of nature's rarest stable isotope ^{180}Ta. Beer, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik); Macklin, R.L. (Oak Ridge National Lab., TN (USA)). pp 945-947 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

The neutron capture cross sections of $^{178\ 179\ 180}$Hf were measured in the energy range 2.6 keV to 2 MeV. The average capture cross sections were derived and fitted in terms of strength functions. Resonance parameters for the observed resonances below 10 keV were determined by shape analysis. Maxwellian averaged capture cross sections were computed for thermal energies with kT between 5 and 100 keV. The cross sections for kT = 30 keV were used to determine the population probability of the 8^- isomeric level in ^{180}Hf by neutron capture as (1.24 +- 0.06)% and the r-process abundance of ^{180}Hf as 0.0290 (Si = 10^6). These quantities served to analyze s- and r-process nucleosynthesis of ^{180}Ta, nature's rarest stable isotope.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 65191038874

38865 (INIS-SU—198, pp 149) eγ coincidences in the decay of ^{202}Po. Kuznetsov, M.Ya.; Kuznetsov, V.V.; Norseev, Yu.V.; Prikhodtseva, V.P.; Usmanov, R.R.; Chumip, V.G.; Yushkevich, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38866 (INIS-SU—198, pp 152-153) New data on transition multipolarity in the ^{208}At → ^{208}Po decay. Dzhelepov, B.S.; Kuznetsova, M.Ya.; Popova, T.I.; Prikhodtseva, V.P.; Chumin, V.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84780104. (CONF-8304144—Summ.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

Short note.

38867 (ZfK—503, pp 8) Measurement of fission products in coincidence with light charged particles in heavy ion reactions. Gippner, P.; Manfrass, P.; Seidel, W.; Sodan, H.; Stary, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Lukjanov, S.M.; Oganesjan, Yu.Z.; Penionzhkevich, Yu.E.; Schilling, K.D. (Joint Inst. for Nuclear Research, Dubna (USSR)). Jun 1983. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

In Joint annual report 1982.

6520 Nuclear Properties And Reactions, A=220 And Above

38868 Mass spectrometric determination of Rb fission yields from ^{3}He and ^{4}He induced fission of ^{238}U and ^{232}Th. Reeder, P.L. (Pacific Northwest Lab., Richland, WA). *Canadian Journal of Chemistry;* **61**: No. 4, 786-794(Apr 1983).

Cumulative and independent fission yields of Rb isotopes have been measured for ^{3}He and ^{4}He induced fission of ^{232}Th and ^{238}U at bombarding energies slightly above the Coulomb barriers. The on-line mass spectrometric technique provided yields for masses 89-97. Mean masses and widths of the Rb independent yield

distributions were obtained and were compared to other fissioning systems with excitation energies up to 160 MeV.

38869 Heavy target fragment yields in the interaction of 28 GeV protons with ^{238}U. Jacak, B.V.; Loveland, W.; Morrissey, D.J.; McGaughey, P.L.; Seaborg, G.T. (California Univ., Berkeley). *Canadian Journal of Chemistry;* **61**: No. 4, 701-707(Apr 1983).

The yields of target fragments from the interaction of 28 GeV protons with ^{238}U have been measured, with special attention being given to those fragments with 160 <= A <= 200. From the measurd fragment yields, isobaric production cross sections were calculated. Significant yields (σ(A) approximately equal to 1 - 10 mb) of heavy target fragments (160 <= A <= 210) were found. These fragments are believed to be the non-fissioning survivors from the population of highly excited residual nuclei produced in the initial p-nucleus collision. A pedagogical calculation of the fission -particle emission competition shows how the initial highly excited heavy nuclei could evaporate approximately equal to 20-50 particles while surviving fission competition.

38870 Neutron-induced fission cross section measurements and calculations of selected transplutonic isotopes. White, R.M. (Lawrence Livermore National Lab., CA (USA)); Browne, J.C. (Los Alamos National Lab., NM (USA)). pp 218-221 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

The neutron-induced fission cross sections of sup(242m)Am and ^{245}Cm have been measured over an energy range of 10^{-4} eV to approx. 20 MeV in a series of experiments at three facilities during the past several years. The combined results of these measurements, in which only submilligram quantities of enriched isotopes were used, yield cross sections with uncertainties of approximately 5% below 10 MeV relative to the ^{235}U standard cross section used to normalize the data. We summarize the resonance analysis of the sup(242m)Am(n,f) cross section in the eV region. Hauser-Feshbach statistical calculations of the detailed fission cross sections of ^{235}U and ^{245}Cm have been carried out over the energy region from 0.1 to 5 MeV and these results are compared with our experimental data.

38871 Work of the IAEA coordinated research programme on the measurement and evaluation of transactinium isotope nuclear decay data. Reich, C.W. (Idaho National Engineering Lab., Idaho Falls (USA)). pp 277-280 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

In 1977, the IAEA organized a Coordinated Research Program to address the needs for precise actinide-isotope decay data identified at the first Advisory Group Meeting on Transactinium Isotope Nuclear Data, held in Karlsruhe in 1975. During the years of its existence, this CRP has made significant strides toward achieving the goals outlined at Karlsruhe. In this paper, we discuss the make-up of the CRP and its work in the areas of decay-data evaluation and measurement. The objectives of the evaluation effort and some of the results to date are summarized. The measurement activity being carried out within the various participating laboratories is presented. Finally, the significant accomplishments resulting from the work of the CRP participants are discussed, together with those tasks which remain to be done in order to be fully responsive to the goals of the program as envisioned at Karlsruhe.

38872 Calculation of the prompt neutron spectrum and average prompt neutron multiplicity for the spontaneous fission of ^{252}Cf. Madland, D.G.; Nix, J.R. (Los Alamos National Lab., NM (USA)). pp 473-478 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Microfiche only, copy does not permit paper copy reproduction0 refs.; 5 figs.

The authors calculate the prompt fission neutron spectrum and average prompt neutron multiplicity for the spontaneous fission of ^{252}Cf. Our calculations are based upon conventional nuclear-evaporation theory and account for the effects of (1) the motion of the fission fragments, (2) the distribution of fission-fragment residual nuclear temperature, and (3) the energy dependence of the cross section for the inverse process of compound-nucleus formation. Because of increased accuracy requirements due to the use of the ^{252}Cf(sf) reaction as a standard, we perform our calculations with greater accuracy than previously. In particular, we calculate the integral for the average energy release without approximation and with the use of more recent mass sources. Following our theoretical calculations, we perform a least-squares adjustment to a specific experimental spectrum and present the comparison.

6530 Nuclear Theory

38873 (IAEA-SMR—108, pp 111-116) **Flow patterns of rotating nuclei.** Bouten, M. (Limburgs Universitair Centrum (Belgium)); Rosina, M. (Ljubljana Univ. (Yugoslavia)); Leuven, P. van (Rijksuniversitair Centrum te Antwerpen (Belgium)). Nov 1983. NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780510. (CONF-821065—).

From Topical meeting on nuclear fluid dynamics ICTP; Trieste, Italy (11 Oct 1982).

The flow line pattern of the probability current distribution in a two-dimensional nucleus calculated on the basis of a schematic model is discussed in qualitative terms. The flow of a determinantal wave packet is found to depend critically on the deformation. The time dependence of the current density is characterized by a quantum mechanical spreading of the wave packet.

38874 (INIS-SU—236, pp 14-17) **Mass-number dependence of leading particle distribution in hadron-nuclear interactions in bremsstrahlung model.** Arushanov, G.G.; Ismatov, E.I.; Arushanov, V.G. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The results of the leading particles distribution estimate in hadron-nuclear interactions on the bremsstrahlung model are presented. Theory is in good agreement in terms of comparison with the available test data on the interaction of proton at momenta from 100 to 500 GeV with protons, Fe and Pb nuclei. It is shown that the leading particles spectrum has the property of the nuclear scaling.

38875 (LA—9933-C-Vol.2, pp 805-808) **Working session summaries.** Gibbs, W.R. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Brief summaries of five working sessions are given. Topics covered are: hypernuclei, nuclear chemistry, hadronic atoms, classical nuclear physics, and new horizons in nuclear physics. Uses of LAMPF II are emphasized.

38876 (LA—9933-C-Vol.2, pp 596-627) **Pion studies at LAMPF II.** Ernst, D.J. (Texas A and M Univ., College Station). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

Current theoretical understanding of the role of pions in the nucleus is reviewed. Pion propagation, pion-nucleon resonance and aspects of the delta isobar are discussed. Some highlights of experimental investigations are given and interesting experiments which could be done on LAMPF-II are suggested.

38877 (LA—9933-C-Vol.2, pp 811-812) **New horizons in Nuclear Physics Working Group.** Gibbs, W.R. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The working sessions on new horizons were held in two parts. The first section consisted of three presentations: energy deposition of antiprotons in nuclei, antiproton reactions, and strange nuclei. The second was a panel discussion on the role of QCD in nuclear physics.

38878 (LA—9933-C-Vol.2, pp 912-929) **Activation studies of the interactions of kaons, antiprotons, and high-energy pions with complex nuclei.** Dropesky, B.J. (Los Alamos National Lab., NM). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—).

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

A discussion is presented of a variety of studies that will be important to pursue of the interactions of high-energy pions, kaons, and antiprotons with complex nuclei at LAMPF II using activation techniques. An evaluation is made of the expected beam intensities relative to these studies, with special emphasis on the problems associated with the fact that the kaon and antiproton beams will be contaminated with a substantial amount of pions. Despite these problems, many studies will be feasible and important contributions will be made to the understanding of the interactions of these probes with complex nuclei.

38879 (NPL—978) **Dirac single particle wave functions in inelastic electron scattering.** Shepard, J.R.; Rost, E.; Siciliano, E.R. (Colorado Univ., Boulder (USA). Dept. of Physics; Villanova Univ., PA (USA). Dept. of Physics). 1983. Contract AC02-81ER40015. 32p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84015129.

We formulate inelastic electron scattering using Dirac single particle wavefunctions to describe the nuclear states. The lower components of these wavefunctions are much larger than those obtained assuming a free space relation with the upper component taken to be a Schroedinger single particle wave function. We note that the impulse approximation to the nuclear current operator is ambiguous in the present case. However, one of the two possible forms yields an explicitly conserved current in the single particle limit. We identify an inelastic amplitude which is linear in the lower components and is therefore very sensitive to the relativity of the bound nucleons. This amplitude is found to be dominant for transverse isoscalar transitions. 34 references.

38880 **Comment on "Fission-fragment angular distributions".** Plasil, F. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **52**: No. 21, 1929-1929(21 May 1984). Contract W-7405-ENG-26.

A Comment on the Letter by P. D. Bond, Phys. Rev. Lett. 52, 414 (1984).

38881 **Implementation of an advanced pairing correction for particle-hole state densities in precompound nuclear reaction theory.** Fu, C.Y. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Science and Engineering;* **86**: No. 4, 344-354(Apr 1984).

An advanced pairing correction for an existing formula of particle-hole state densities, needed in calculations of cross sections with the precompound nuclear reaction theory, is examined. The Pauli correction is derived to be consistent with this pairing correction. The accuracy of the pairing correction plus the Pauli correction is shown to be sufficient for applied calculations. Numerical solutions of the pairing equations, needed for generating the corrections, have been carried out. The relevant numerical results are presented as simple functions of the excitation energy and the exciton number. A relationship between the pairing correction for particle-hole state densities and the pairing correction for the total state densities in the closed-form formulation is developed. Utilization of the existing level-density parameters and data for deducing parameters for the particle-hole state densities are shown.

38882 **Spin dependence of NN and NNπ reactions and the question of dibaryon resonances.** Silbar, R.R. (Los Alamos National Lab., NM). *Comments on Nuclear and Particle Physics;* **12**: No. 4, 177-189(Mar 1984).

Recent experiments on the spin dependence of the coupled NN and NNπ systems are reviewed and compared with theory. Conventional models involving the interactions of mesons and nucleons appear capable of explaining the rich spin dependence observed.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 65400037541, 37981, 38229, 38287, 38376, 38485, 38721, 38722, 38731, 38787, 38896

38883 (CONF-840614—82) **Effectiveness of vector computers in large radiation transport calculations.** Rhoades, W.A.; Childs, R.L. (Oak Ridge National Lab., TN (USA); Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014278.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

Vector computers have provided reduced CPU charges and have led to the implementation of procedures which were previously judged too CPU intensive. They promise to reduce long turnaround times if the problems of system saturation can be avoided. We have found that extensive programming effort was required to achieve the desired code performance. The power of the large computers makes central computing centers practical. Our experience with two such centers has been good, and we believe that, with appropriate administrative policies, the centers could lead to improved efficiency, reliability, and responsiveness in the maintenance and application of codes.

38884 (INIS-SU—236, pp 52-55) **Ionization energy losses of relativistic positrons in silicon monocrystals.** Adejshvili, D.I.; Bochek, G.L.; Vit'ko, V.I. (and others). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Ionization-loss spectra have been measuremed for 1.2 GeV positrons transmitted through a silicon single crystals at different angles to the crystal axis. For the particles aligned with the axis the most probable energy loss dicreases by 20%.

38885 (INIS-SU—236, pp 210-213) **Specific features of neutron scattering on a void lattice in metals.** Dzyublik, A.Ya.; Sugakov, V.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

The cross-section for coherent and incoherent scattering of neutrons by superlattice of voids in a crystal are calculated in kinematic approximation. The distribution of centres and radii of voids is taken into account. It the role of bound and virtual neutron levels in void is considered. The dynamical theory of ultracoild neutrons scattering by a lattice of voids is built.

38886 (INIS-SU—236, pp 74-77) **Study on the process of ultracold neutron storage in the aluminium vessel.** Kosvintsev, Yu.Yu.; Morozov, V.I.; Terekhov, G.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

By cooling the leak-proof aluminium vessel down to 80 K the probability for ultracold neutron losses decreases to a level close to theoretical one. It has been shown that the additional losses of ultracold neutrons in aluminium vessels are resulted from ultracold neutron heating which probability is strongly dependent on temperature. By freezing heavy ice layer over the aluminium vessel surface a "pure" vessel is produced providing the ultracold neutron storage time over the period equal to their lifetime till β-decay.

38887 (INIS-SU—236, pp 79-84) **Study on the process of ultraviolet neutron interaction with surface of copper and beryllium.** Kosvintsev, Yu.Yu.; Kushnir, Yu.A.; Morozov, V.I.; Terekhov, G.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

It has been shown that the main reason for anomalous leak of the ultracold neutrons out of the copper and beryllium vessels with degassed walls is a result of their heating. The heated neutron energy walls is a result is 25 and 50 MeV for the beryllium and copper vessels, respectively. Studied is the temperature dependence of theultacoild neutron heating probability and the heated u. c. neutron energy.

38888 (N—8329169) **Heavy ion transport in the straight ahead approximation.** Wilson, J.W. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Jun 1983. 22p. (NASA-TP—2178). NTIS, PC A02/MF A01.

An as yet unsolved problem in space radiation protection is the necessary relation between the external cosmic ray heavy ion fluence and the resultant environment within the spacecraft. Such a relation involves the transport of such ions through extended materials. Presented is a derivation of the solution of the transport equation for heavy ions in the straight ahead approximation for directed beam applications. An iterative scheme for the solution of the inhomogeneous integral transport equations is applied to a neon ion beam in water. The iterative scheme requires transport coefficients as input, which are determined from the available data on ion nuclear reactions. The iteration converged for the neon beam in water. Thus this iterative scheme appears to be a suitable approximation of heavy ion transport.

38889 **Flux-limited diffusion theory with anisotropic scattering.** Pomranig, G.C. (Lawrence Livermore National Laboratory, Livermore, CA). *Nuclear Science and Engineering;* **86**: No. 4, 335-343(Apr 1984).

The Chapman-Enskog procedure of kinetic theory is used to obtain a flux-limited diffusion theory for linear transport problems. The analysis is carried out within the context of multigroup theory, with an arbitrary scattering matrix involving anisotropic effects for both within-group and group-to group scattering. Aside from the question of flux limiting, a new definition of the transport cross section arises naturally from the analysis.

38890 **Determination of anomalous scattering lengths of samarium for thermal neutrons.** Engel, D.W.; Koetzle, T.F. (Durban-Westville Univ., South Africa). *Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography;* **40**: No. 2, 99-102(1 Mar 1984).

Anomalous scattering lengths of natural Sm for thermal neutrons with wavelengths between 0.827 and 1.300 A have been determined by single-crystal diffraction from a Sm complex of known structure. 140 selected reflections were measured at a temperature of 37 K at each wavelength and b_0+b' and b'' refined in each case. The values obtained are in good agreement with values obtained from a Breit-Wigner calculation using tabulated absorption resonance parameters for ^{149}Sm. A value of $b_0 = 4.3 +- 0.2$ fm is deduced from the diffraction experiments.

38891 **Bremsstrahlung studies with conducting and non-conducting radiators.** Singh, M.; Powar, M.S. (Nuclear Science Laboratories, Department of Physics, Punjabi University, Patiala-147 002, India). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 896-899(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

Total bremsstrahlung intensities emanating from targets of conducting and non-conducting materials have been measured by completely stopping the beta radiations in the targets. While confirming the approximately linear variation of bremsstrahlung intensity with target atomic number the values of effective atomic numbers for multi-component systems obtained from the present measurements agree with those calculated from their chemical compositions. It is found that the target bremsstrahlung increases more rapidly with beta end-point energy than the internal bremsstrahlung from the beta emitters. Therefore it will be more appropriate to use beta emitters with high end-point energies and targets of dielectrics with high effective atomic numbers in studies of bremsstrahlung attenuation with charge build up.

38892 **Time dependence linear transport III convergence of the discrete ordinate method.** Wilson, D.G. (Mathematics and Statistics Research Department, Union Carbide Corporation, Nuclear Division, P.O. Box Y, Bldg. 9704-1, Oak Ridge, Tennessee 37830). *Transport Theory and Statistical Physics;* **12**: No. 4, 369-390(Oct 1983).

In this paper the uniform pointwise convergence of the discrete ordinate method for weak and strong solutions of the time dependent, linear transport equation posed in a multidimensional, rectangular parallelepiped with partially reflecting walls is established. The first result is that a sequence of discrete ordinate solutions converges uniformly on the quadrature points to a solution of the continuous problem provided that the corresponding sequence of truncation errors for the solution of the continuous problem converges to zero in the same manner. The second result is that continuity of the solution with respect to the velocity variables guarantees that the truncation erros in the quadrature formula go the zero and hence that the discrete ordinate approximations converge to the solution of the continuous problem as the discrete ordinate become dense. An existence theory for strong solutions of the the continuous problem follows as a result.

38893 **Formulation of the Fokker-Planck equation in terms of the Riemann-Christoffel tensor.** Andrade, A. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Transport Theory and Statistical Physics;* **12**: No. 4, 391-412(Oct 1983).

In this note, a reformation of the divergence (Landau) form of the Fokker-Planck equation in terms of the fourth order Riemann-Christoffel tensor is presented. It is shown that derivatives of the Rosenbluth potentials of no higher than second order result within the vector components on which the divergence operator acts.

38894 **Problems in the abstract theory of stationary one dimensional transport.** Greenberg, W.; van der Mee, C.V.M. (Department of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Transport Theory and Statistical Physics;* **12**: No. 4, 413-420(Oct 1983). Contract AS05-80ER10711.

Eight unsolved problems, related to the abstract stationary one-dimensional linear transport equation, are presented.

38895 Solid state effects on thermal neutron cross sections and on low energy resonances. Harvey, J.A.; Mook, H.A.; Hill, N.W.; Shahal, O. (Oak Ridge National Lab., TN (USA)). pp 961-964 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

The neutron total cross sections of several single crystals (Si, Cu, sapphire), several polycrystalline samples (Cu, Fe, Be, C, Bi, Ta) and a fine powder copper sample have been measured from 0.002 to 5 eV. The Cu powder and polycrystalline Fe, Be and C data exhibit the expected abrupt changes in cross section. The cross section of the single crystal of Si is smooth with only small broad fluctuations. The data on two 'single' Cu crystals, the sapphire crystal, cast Bi, and rolled samples of Ta and Cu have many narrow peaks approx. 10^{-3} eV wide. High resolution (0.3%) transmission measurements were made on the 1.057-eV resonance in ^{240}Pu and the 0.433-eV resonance in ^{180}Ta, both at room and low temperatures to study the effects of crystal binding. Although the changes in Doppler broadening with temperature were apparent, no asymmetries due to a recoilless contribution were observed.

6550 Medical Physics

REFER ALSO TO CITATION(S) 65500038246, 38336, 38511, 38512, 38513, 38514, 38550, 38580, 38597

38896 (INIS-mf—9005) 11. Regional congress of IRPA. Austrian-Hungarian-Yugoslavian radiation protection meeting. Recent developments and new trends in radiation protection. Tschirf, E.; Hefner, A. (Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna). 1983. 136p. (CONF-830995—Summ.). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84780512.

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

Papers presented were entered into the data base separately. (WHK)

38897 (JINR—18-83-53) Two-dimensional spatial distributions of dose fields in water absorber irradiated by 0.05-10 GeV nucleons. Serov, A.Ya.; Sychev, B.S.; Cherevatenko, E.P.; Chernov, S.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701535.

The investigation of spatial distribution formation laws of complete absorbed and equivalent dose, as well as of its components in an absorber is made in order to derive quantitative information about characteristics of dose field, produced in phantom by the therapeutic high energy neutron and proton beam of JINR Nuclear Problems Laboratory. The calculations have been carried out using the "MEDICA" computer program, realizing the successive collision method as applied to narrow nucleon beams, falling on absorber and having arbitrary energy spectrum. The calculated results agree satisfactorily with the measurement results and could be used as initial information for calculating microdosimetric distributions of energy releases in phantom for real conditions of radiobiological experiments on similar beams.

38898 Performance of track etch dosemeters used for neutron personnel monitoring. Swaja, R.E.; Sims, C.S.; Greene, R.T. (Oak Ridge National Lab., TN (USA)); Schraube, H.; Burger, G. (Gesellschaft fuer Strahlen- und Umweltforschung, Muenchen, Neuherberg (Germany, F.R.). Neutron Lab.). *Radiation Protection Dosimetry;* 6: No. 1-4, 221-224(1984). (CONF-830953—).

From 7. international solid state dosimetry conference; Ottawa, Canada (27 Sep 1983).

A neutron dosimetry intercomparison study was conducted April 19-23, 1982, as a joint effort between the Oak Ridge National Laboratory and the Commission of European Communities. A total of nine different radiation fields were considered including four mixed-field spectra produced using the Health Physics Research Reactor, four monoenergetic neutron fields generated by accelerators, and one D_2O-moderated californium source spectrum. The performance of CR-39 recoil track and thorium fission track personnel neutron dosemeters is assessed based on results obtained during this intercomparison.

38899 Highlights of the sixth international intercomparison of environmental dosemeters. Gesell, T.F.; Kalbeitzer, F.L. (Department of Energy, Idaho Falls, ID (USA). Radiological and Environmental Sciences Lab.); Planque, G. de (Department of Energy, New York (USA). Environmental Measurements Lab.). *Radiation Protection Dosimetry;* 6: No. 1-4, 265-268(1984). (CONF-830953—).

From 7. international solid state dosimetry conference; Ottawa, Canada (27 Sep 1983).

The sixth in a series of intercomparisons of environmental dosemeters was conducted at the United States Department of Energy's Idaho National Engineering Laboratory during the late summer and early fall of 1982. These studies permit assessment of the state of the art of environmental dosimetry and allow participants to compare their results with those of their counterparts at other laboratories. Data were obtained for 169 sets of dosemeters submitted by 119 laboratories from 27 countries. Frequency distributions of the results for the various test categories are provided and the results are tabulated by dosemeter type. Performance as a function of calibration technique and other factors is noted.

38900 Uncertainty analysis of benchmark dosimetry measurements. Wagschal, J.J. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Maerker, R.E.; Broadhead, B.L. (Oak Ridge National Lab., TN (USA)). pp 436-440 of Nuclear data for science and technology. Proceedings of the international conference held in Antwerp, 6-10 September 1982. Boeckhoff, K.H. (ed.) (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Dordrecht, Netherlands; D. Reidel (1983). (CONF-820942—; EUR—8355).

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Includes author and CINDA indexes.

The joint consistency of a series of measured quantities and their calculated counterparts is defined. Ten measurements of average cross sections or average cross-section ratios in benchmark ^{252}Cf spontaneous fission neutron fields are analyzed. The consistency of calculations based on a pure Maxwellian fission spectrum and ENDF/B-V dosimetry cross-sections, and of the corresponding measured values is being tested. Dosimetry cross-section covariance matrices based on ENDF/B-V, and covariances of the measured values are used in the analysis. Clear evidence of an inconsistency is presented and discussed. Removing one measurement results in a consistent data set.

38901 Studies with encapsulated sources of ^{125}I. III. Microdosimetry using a non-metallic wall-less proportional counter. Kliauga, P.J.; Rossi, H.H. (Columbia Univ. Coll. of Physicians & Surgeons, New York, NY). *International Journal of Radiation Oncology, Biology and Physics;* 8: No. 11, 1963-1968(Nov 1982). Contract AC02-78EV04733.

A significant problem in measurement of microdosimetric spectra of low energy X rays has been the perturbing influence of the counters used in experiments. In order to perform accurate measurement with ^{125}I photons and other soft X rays having energies less than 100 keV, a special counter was constructed having no metal parts. The construction is of the grid-defined "wall-less" type, contained inside a plastic spherical shell. The plastic was chosen to match the energy absorption coefficient of tissue at 25 keV as closely as possible; therefore, conventional tissue-equivalent A-150 was replaced by an "air equivalent" type, C-552, which at 25 keV matches tissue to within a few percent. This material, based on the plastic polyvinylidene fluoride has additional advantages in terms of tensile strength and rigidity, for the purpose of molding delicate

structures. The gas used was a propane-based tissue-equivalent type, modified to match the plastic. A human hair, coated with graphite, was used as the central collecting wire. The construction and details of this detector are described, and measurements are reported of ^{125}I and 60 keV photons from ^{241}Am, as well as high energy photons from ^{137}Cs and ^{60}Co.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 65600038722

38902 **(IC—83/93) Rate equation formalism for the A.C. conductivity in amorphous semiconductors.** Pramanik, M.H.A. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702537.

In both non-degenerate and degenerate cases expressions for the A.C. conductivity are derived from the Boltzmann's rate equation without taking into account the exclusion factor. It is found that these expressions are identical with those of Butcher's rate equation formalism.

38903 **(IC—83/113) Theoretical description of the properties of magnetization fluctuations in the vicinity of phase transition from paramagnetic phase to ferromagnetic phase with domain structure.** Wasilewski, W. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702536.

This paper presents a theoretical description of the phase transition from a paramagnetic phase P to the homogeneous and domain structure ferromagnetic phases within the phenomenological theory of phase transitions.

38904 **(UM-P—83/22) Channeling contrast microscopy: application to semiconductor structures.** McCallum, J.C.; McKenzie, C.D.; Lucas, M.A.; Rossiter, K.G.; Short, K.T.; Williams, J.S. (Melbourne Univ., Parkville (Australia). School of Physics). 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702538.

A new technique is demonstrated for the imaging of semiconductor structures. The technique involves the use of a channeled $^4He^+$ microbeam, scanned across the surface to provide a channeling -contrast image of subsurface lattice disorder and atom location. The present arrangement provides a lateral resolution of about 5μ and an in-depth resolution of about 30A. The technique is applied to the imaging of small, laser annealed regions on ion implanted silicon wafers.

38905 **Elastic wave scattering by a surface-breaking or subsurface planar crack.** Visscher, W.M. (Theoretical Division, B262, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **56**: No. 3, 713-725(1 Aug 1984).

A boundary integral representation of the displacement field is developed and solved for the crack-opening displacement by expressing the latter on the crack surface as an expansion in localized functions, whose parametrization is determined by fitting exactly-known cross sections. Numerical results are presented for scattering of antiplane (SH) waves as a function of frequency from surface-breaking and buried 2D cracks for a variety of crack inclinations and burial depths. The theory and the method apply to the 3D case. Its numerical implementation will be straightforward but tedious.

38906 **Exactly solvable irreversible processes on one-dimensional lattices.** Wolf, N.O.; Evans, J.W.; Hoffman, D.K. (Ames Laboratory and Department of Chemistry, Iowa State University, Ames, Iowa 50010). *Journal of Mathematical Physics (New York);* **25**: No. 8, 2519-2526(Aug 1984). Contract W-7405-ENG-82.

We consider the kinetics of a process where the sites of an infinite 1-D lattice are filled irreversibly and, in general, cooperatively by N-mers (taking N consecutive sites at a time). We extend the previously available exact solution for nearest neighbor cooperative effects to range N cooperative effects. Connection with the continuous "cooperative car parking problem" is indicated. Both uniform and periodic lattices, and empty and certain partially filled lattice initial conditions are considered. We also treat monomer "filling in stages" for certain highly autoinhibitory cooperative effects of arbitrary range.

38907 **Exactly solvable irreversible processes on Bethe lattices.** Evans, J.W. (Ames Laboratory and Department of Chemistry, Iowa State University, Ames, Iowa 50010). *Journal of Mathematical Physics (New York);* **25**: No. 8, 2527-2532(Aug 1984).

We consider the kinetics of processes where the sites of a Bethe lattice are filled irreversibly and, in general, cooperatively by monomers, dimers, or polyatomics. For nearest neighbor and sometimes more general cooperative effects (including random filling as a special case), we show that the infinite hierarchy of rate equations for probabilities of empty subconfigurations can be exacty truncated and solved using a shielding property of empty sites. We indicate, in certain cases, a connection between these Bethe lattice solutions and certain approximate truncation solutions for corresponding processes on "physical" 2-D and 3-D lattices with the same coordination number.

38908 **Classical stochastic diffusion theory for thermal desorption from solid surfaces.** Redondo, A.; Zeiri, Y.; Goddard, W.A. III. (Electronics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **2**: No. 3, 550-560(Jul 1984). Contract AM03-76SF00767.

As a first step in the microscopic study of dynamic processes on surfaces and at interfaces, we have considered the thermal desorption of adsorbed species on solid surfaces. We review recent developments based on a classical stochastic diffusion formulation. Using this theory, we obtained a simple rate expression, $R = (\Omega_0/2\pi)\, f(T)\exp(-D/\text{sub e}//kT)$, where Ω_0 is the surface-adsorbate vibrational frequency and D/sub e/ the dissociation energy. For atoms $f(T) = 1$, whereas for molecules $f(T)$ depends on the parameters for the frustrated rotations at the surface. The effect of coverage on the rate of desorption and the process of desorption into a fluid are also examined. Finally, we discuss the relationship between our theory and the expressions obtained from activated complex (transition-state) theory.

38909 **Simple model to explain inhomogeneous structures in shocked solids.** Vineyard, G.H. (Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **54**: No. 12, 7198-7200(Dec 1983). Contract AC02-76CH00016.

A model is proposed to explain observations of inhomogeneous yielding in shocked solids. Instead of seeking hydrodynamic or elastic-plastic instabilities in an initially homogeneous specimen, it is proposed that the material under shock conditions (at pressures well above the yield strength) may be characterized as a viscous medium with initially inhomogeneous viscosity. Such a viscosity might be caused by an inhomogeneous distribution of dislocations. Assuming that the viscosity also decreases with temperature in a simple way, suitably truncated hydrodynamic equations can be solved analytically and predict a tendency toward runaway of temperature and deformation in localized regions.

6561 Superconductivity

REFER ALSO TO CITATION(S) 65610037946, 37952, 38119

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 65700038718, 38908

38910 **(AD-A—140436/7) Quantum solutions and strange solutions in many-body problems. Final report 1 Jul 81-31 May 83.** Mattis, D.C. (Utah Univ., Salt Lake City (USA). Dept. of Physics). 1 Jul 1983. 6p. NTIS, PC A02/MF A01.

A summary is given of research accomplished and papers written under this grant. The research covered statistical and many-body theoretical physics, especially, new mathematical techniques for solving problems.

38911 **(FEI—1306) One of the variants of the method of parabolic runs for solving two-dimensional elliptical type equations.** Ginkin, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701540.

One of the schemes of the method of parabolic runs for solving two-dimensional elliptical differential equations is considered. The effectiveness of the scheme versus the value of iterative parameter introduced in it is illustrated in model problems. An effective method is suggested for solving the neumann problem for an equation of the heat conductivity type. It is shown experimentally that in case of variable coefficients of initial differential equations the effectiveness of the scheme considered weakly depends on the relation of the coefficient maximum value to the minimum one. A standard NFPP subprogram is described for solving two-dimensional differential elliptical equations using the method suggested.

38912 (LA—9933-C-Vol.2, pp 580-595) **Search for violations of quantum mechanics.** Ellis, J.; Hagelin, J.S.; Nanopoulos, D.V.; Srednicki, M. (Stanford Univ., CA). Nov 1983. NTIS, PC A23/MF A01. Order Number DE84004473. (CONF-830798—). Contract AC03-76SF00515.

From 3. LAMPF II workshop; Los Alamos, NM, USA (18 Jul 1983).

The treatment of quantum effects in gravitational fields indicates that pure states may evolve into mixed states, and Hawking has proposed modifications of the axioms of field theory which incorporate the corresponding violation of quantum mechanics. In this paper the authors propose a modified Hamiltonian upper bounds on the violation of quantum mechanics in different phenomenological situations. The most sensitive probes for violations of quantum mechanics the authors have found are the Kappa^0-Kappa^0 system and long baseline neutron interferometry experiments. In both cases the authors find upper bounds of about 2×10^{-21} GeV on contributions to the single-particle "Hamiltonian" which violate quantum mechanical coherence. The authors discuss how these limits might be improved in the future.

38913 **Generalized rays in first-order optics: Transformation properties of Gaussian Schell-model fields.** Simon, R.; Sudarshan, E.C.G.; Mukunda, N. (Department of Physics, Indian Institute of Science, Bangalore 560012, Karnataka, India). *Physical Review [Section] A: General Physics;* **29**: No. 6, 3273-3279(Jun 1984). Contract AS05-76ER03992.

Propagation characteristics of Gaussian Schell-model fields through first-order optical systems and in free space are analyzed by the method of generalized rays. This allows the development of a simple geometrical description of these processes. The invariance of the degree of global coherence is established in full generality. Asymptotic behavior under free propagation and the emergence of a far-zone universal structure are analyzed. New invariants associated with incoherent superpositions of such fields are found.

38914 **Uniform expansion of the transition rate in Kramer's problem.** Matkowsky, B.J.; Schuss, Z.; Tier, C. (Department of Engineering Sciences and Applied Mathematics, The Technological Institute, Northwestern University, Evanston, Illinois 60201). *Journal of Statistical Physics;* **35**: No. 2, 443-456(May 1984). Contract AC02-78ER04650.

Kramers' model of diffusion over potential barriers, e.g., chemical reactions, based on the noise activated escape of a particle from a potential well, is considered. Kramers derived escape rates valid for intermediate and large dampling, and in a separate analysis, for small damping. In the small damping limit, Kramers' intermediate result reduces to the transition state rate which does not agree with the small damping result. A new escape rate is derived that is uniformly valid for all values of the damping coefficient. The new rate reduces to Kramers' results in the appropriate limits and, in particular, connects Kramers' intermediate and small damping results.

38915 **Numerical solution of eigenvalues for the Schroedinger equation.** Neuberger, J.W.; Noid, D.W. (Oak Ridge National Lab., TN). *Chemical Physics Letters;* **104**: No. 1, 1-3(27 Jan 1984).

A method is proposed and tested for the quantum mechanical calculation of eigenvalues for a hamiltonian consisting of three coupled oscillators. The agreement of eigenvalues with a large variational calculation is excellent.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 65800038655, 38905

38916 **(N—8328878) Entropy functions for symmetric systems of conservation laws. Final Report.** Tadmor, E. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Jun 1983. 10p. (NASA-CR—172139; REPT—83-16). NTIS, PC A02/MF A01.

It is shown that symmetric systems of conservation laws are equipped with a one-parameter family of entropy functions. A simple symmetrizability criterion is used.

38917 **(UCRL—53553) Comparison of the multigrid and ICCG methods in solving the diffusion equation.** Voytko, M.H. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84014409.

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The performance of the multigrid method and the Incomplete Cholesky Conjugate Gradient (ICCG) method are compared in this paper. These methods are used in the context of solving the diffusion equation numerically. Both methods are described and test cases and computational results presented. The method of lines is used to solve the diffusion equation. Central difference formulas are used to approximate the spatial derivatives. The backward Euler difference operator is used to approximate the time derivatives. The multigrid and ICCG methods are used to solve the implicit equations. The multigrid method used a series of grids on the region over which the diffusion equation is to be solved. Each of the grids contains a subset of the points of the previous grid. The finest grid contains all of the points involved in the spatial differencing. A coefficient matrix containing the coupling coefficients is generated for each grid. On the coarsest grid, the resulting system may be solved directly. The solution is used to interpolate solutions at points on the finer grids. Relaxation sweeps are performed to accelerate the convergence at interpolated points. The details of the multigrid algorithm and the special difficulties the diffusion equation poses are presented in the chapter on the multigrid method. The ICCG method is a variation of the generalized conjugate gradient method. An incomplete Cholesky decomposition is used in splitting the coefficient matrix. Both the generalized and ICCG methods are described. The metric used to compare the multigrid and ICCG methods is the work unit. A work unit corresponds to the amount of work done in performing one relaxation sweep. Since the ICCG method does not involve relaxation sweeps, some correlations be-

tween the work involved in one ICCG iteration and a relaxation sweep are made. The two methods are compared on four test cases and the results presented.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 70010038717, 39015, 39037, 39041

38918 **(AD-A—140229/6) Production of plasma with variable, radial electric fields. Progress report.** Kustom, B.; Merlino, R.L.; D'Angelo, N. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Feb 1984. 12p. NTIS, PC A02/MF A01.

A device is described suitable for plasma wave experiments requiring relatively large, variable, radial electric fields perpendicular to a static magnetic field. By separately adjusting the potentials of two independent, coaxial discharge plasmas, the authors produced plasmas with a radial electric field E sub r < approximately 5 V/cm.

38919 **(CLM-R—239) High density operation in DITE with neutral beam injection.** Hugill, J.; Lomas, P.J.; Wootton, A.J. (UKAEA Culham Lab., Abingdon). Mar 1983. 43p. HMSO, London, price Pound 3.00.

The paper describes experiments on DITE tokamak to determine the maximum density which could be achieved with ohmic heating and with the injection of up to IMW of fast neutrals. Energy balances are constructed for some typical high density discharges, and the behaviour of global confinement and β-values at high density is discussed. For some conditions, injection produces a density clamp; this phenomena is discussed in detail. The nature of the disruptive density limit with high power neutral injection and the scaling of this limit is investigated in depth.

38920 **(CONF-790867—2) Flow and temperature fields in a free discharge inductively coupled plasma.** Gagne, R.; Boulos, M.I.; Barnes, R.M. (Sherbrooke Univ., Quebec (Canada). Dept. of Chemical Engineering; Massachusetts Univ., Amherst (USA). Dept. of Chemistry). 1979. Contract AC02-77EV04320. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012339.

From 4. international symposium on plasma chemistry; Zurich, Switzerland (27 Aug 1979).

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Computations were made of the flow and temperature fields in an inductively coupled argon plasma at atmospheric pressure under confined and free discharge conditions. The model takes into account gravity effects and swirl in the sheath gas. Natural convection was found to have a negligible effect on the flow and temperature fields under confined discharge conditions but a significant effect for the free discharge. The back flow in the discharge was substantially reduced in the presence of swirl for swirl velocities over the range 0-50 m/s. Also with a mode-rate increase in swirl, the conduction heat flux to the wall decreased but increased with the further increase in swirl. From an overall energy balance point of view, conductive heat flux to the wall of the plasma confinement tube was substantially lower for a free plasma discharge compared to that for a confined plasma.

38921 **(CONF-790867—3) LDA measurements under plasma conditions.** Lesinski, J.; Mizera-Lesinska, B.; Fanton, J.C.; Boulos, M.I. (Sherbrooke Univ., Quebec (Canada). Dept. of Chemical Engineering). 1979. Contract AC02-77EV04320. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013217.

From 4. international symposium on plasma chemistry; Zurich, Switzerland (27 Aug 1979).

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A study was made of the application of Laser Doppler Anemometry (LDA) for the measurement of the fluid and particle velocities under plasma conditions. The flow configuration, is that of a dc plasma jet called the principal jet, in which an alumina powder of a mean particle diameter of 115 μm and a standard deviation of 11.3 μm was injected using a secondary jet. The plasma jet immerged from a 7.1 mm ID nozzle while that of the secondary jet was 2 nm in diameter. The secondary jet was introduced at the nozzle level of the plasma jet directed 90° to its axis. Details of the nozzle and the gas flow system are shown in Figure 2.

38922 **(CONF-800610—12) Particle and gas velocity measurements in a dc plasma jet.** Lesinski, J.; Mizera-Lesinska, B.; Jurewicz, J.; Boulos, M.I. (Sherbrooke Univ., Quebec (Canada). Dept. of Chemical Engineering). 1980. Contract AC02-77EV04320. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84012970.

From American Institute of Chemical Engineering conference; Philadelphia, PA, USA (8 Jun 1980).

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Measurements were made, using Laser Doppler Anemometry (LDA), of the velocity of 53 μm alumina particles as they are injected in a dc plasma jet operated with an argon-nitrogen mixture (18.9 l/min argon and 4.7 l/min nitrogen) at a power level of 15.2 kW. Results obtained at distances between 5 and 150 mm from the nozzle showed the particles to penetrate the plasma jet and attain the gas velocity at about 50 mm from their point of injection. Plasma velocity measurements in the core region of the jet proved to be particularly difficult. Limitations of the LDA system with regard to its spatial resolution and seeding requirements are discussed.

38923 **(CONF-8309147—2) Study of electron beam production by a plasma focus.** Smith, J.R.; Luo, C.M.; Rhee, M.J.; Schneider, R.F. (Naval Surface Weapons Center, Silver Spring, MD (USA); Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). 1983. Contract AS05-78ER05940. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014816.

From 3. international workshop on plasma focus research; Stuttgart, F.R. Germany (12 Sep 1983).

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A preliminary investigation of the electron beam produced by a plasma focus device using a current charged transmission line is described. Electron beam currents as high as 10 kA were measured. Interaction of the extracted beam and the filling gas was studied using open shutter photography.

38924 **(DOE/ER/52062—6) Axially averaged-radial transport model of tokamak edge plasmas.** Prinja, A.K.; Conn, R.W. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). May 1984. Contract AT03-80ER52062. 28p. (CONF-840520—17). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015016.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

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A two-zone axially averaged-radial transport model for edge plasmas is described that incorporates parallel electron and ion conduction, localized recycling, parallel electron pressure gradient effects and sheath losses. Results for high recycling show that the radial electron temperature profile is determined by parallel electron conduction over short radial distances (~ 3 cm). At larger radius where T/sub e/ has fallen appreciably, convective transport becomes equally important. The downstream density and ion temperature profiles are very flat over the region where electron conduction dominates. This is seen to result from a sharply decaying velocity profile that follows the radial electron temperature. A one dimensional analytical recycling model shows that at high neutral pumping rates, the plasma density at the plate, n/sub ia/, scales linearly with the unperturbed background density, n/sub io/. When ionization dominates n/sub ia//n/sub io/ ~ exp(n/sub io/) while in the intermediate regime n/sub ia//n/sub io/~ exp ~ n/sub io/. Such behavior is qualitatively in accord with experimental observations.

38925 **(DOE/ER/52062—T5) Plasma surface interactions in magnetic fusion systems. Annual progress report.** Conn, R.W.; Prinja, A.K. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Jul 1984. Contract AT03-80ER52062. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015255.

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Brief summaries of major accomplishments were given for the following areas: (1) tokamak edge plasma theory and modelling, (2) tandem mirror edge plasma theory and modelling, and (3) neutral atom transport in plasmas. (MOW)

38926 **(DOE/ER/53104—8) Annual progress report on fusion plasma theory task I: magnetic confinement fusion plasma theory for the period January 1, 1984-September 30, 1984.** Callen, J.D. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering and Physics). Jun 1984. Contract AC02-80ER53104. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014941.

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The research performed under this contract over the past nine months has concentrated on some key tandem mirror plasma confinement and heating issues (heating at the second electron cyclotron harmonic, pumping of electrons by ICRF in Phaedrus, pondermotive force effects on MHD stability, moments approach to tandem mirror transport), and on some aspects of tokamak plasma confinement (long mean free path resistive MHD, Tokapole II equilibria with imbedded coils and internal separatrices, ballooning modes on a divertor separatrix). Progress in these and some other miscellaneous areas are briefly summarized in this progress report.

38927 **(DOE/ER/53104—9) Fusion plasma theory. Task II. ECRH and transport modeling in tandem mirrors and divertor physics. Annual progress report, January 1, 1984-September 30, 1984.** Emmert, G.A. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Jun 1984. Contract AC02-80ER53104. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014939.

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The research performed under Tank II of this contract has focused on (1) the coupling of an ECRH ray tracing and absorption code to a tandem mirror transport code in order to self-consistently model the temporal and spatial evolution of the plasma, and (2) the further development of semi-analytical models for plasma flow in divertors and pumped limiters. Work on these topics is briefly summarized in this progress report.

38928 **(DOE/ER/53104—10) Annual progress report on fusion plasma theory task III: auxiliary heating in tokamaks and tandem mirrors.** Scharer, J.E. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). Jun 1984. Contract AC02-80ER53104. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014940.

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The research we have accomplished during the past year has focussed on ICRF coupling, heating and breakeven studies for tokamaks and ECRF fundamental second harmonic heating in tandem mirrors. The studies have included ICRF Fokker-Planck heating and breakeven studies for large tokamaks such as JET, fundamental work on a new wave power absorption and conservation relation for ICRF in inhomogeneous plasmas, a formulation and code development for ICRF waveguide coupling in tokamak edge regions. ECRF ray tracing studies have been carried out for fundamental and second harmonic propagation, absorption and whistler microinstabilities in tandem mirror plug and barrier regions of Phaedrus, TMX-U and TASKA. The two-dimensional velocity space, time dependent Fokker-Planck heating studies have concentrated on D-T breakeven scenarios for fundamental minority deuterium and second harmonic tritium regimes.

38929 **(DOE/ER/53135—T1) Fast waves near the lower hybrid frequency. Final contract report.** McWilliams, R. (California Univ., Irvine (USA). Dept. of Physics). 1984. Contract AT03-82ER53135. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015217.

The main function of this contract has been to advance the theory of fast waves near the lower hybrid frequency. Special emphasis was to be given to aspects which would assist experimentalists in planning and performing experiments to test the feasibility of using the fast wave for plasma heating and current drive. Evanescent and propagating conditions for the wave were to be determined. Possible antennas for launching the waves were to be determined. Coupling coefficients of the waves into the plasma were to be found. The results were to be applied to present day and reactor grade plasma parameters.

38930 **(DOE/ER/53154—64) Experimental observation of plasma neoclassical currents.** Zarnstorff, M.C.; Prager, S.C. (Wisconsin Univ., Madison (USA). Dept. of Physics). Mar 1984. Contract AC02-83ER53154. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015706.

Experimental observations of the bootstrap and Pfirsch-Schlueter currents, predicted by neoclassical transport theory, are presented. Detailed measurements of the parallel plasma currents in a toroidal octupole agree, within the separatrix, with theoretical predictions. Observations of the spatial structure, collisionality and toroidal field dependence of the complete current and the ion portion of the current are discussed.

38931 **(DOE/ER/53154—67) Experimental observation of neoclassical currents.** Zarnstorff, M.C. (Wisconsin Univ., Madison (USA). Dept. of Physics). Jun 1984. Contract AC02-83ER53154. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015113.

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The parallel and perpendicular equilibrium currents have been experimentally studied in the Levitated Octupole, with toroidal field. Observations of the spatial structure, collisionality and toroidal field dependence of the complete current and the ion portion of the current are presented. Experimentally measured currents are compared to neoclassical current distributions calculated for the actual machine geometry. Measurements of the total plasma parallel current for absolute-MHD-stable flux surfaces (inside the separatrix) agree well with theory, showing the bootstrap and Pfirsch-Schlueter currents as predicted by neoclassical transport theory. On average-MHD-stable flux surfaces (outside the separatrix) there is more parallel current than predicted by theory, though the spatial structure is correct. Separate measurements of the ion parallel and perpendicular currents agree with theory, showing the lack of measurable ion poloidal rotation in all situations.

38932 **(DOE/ET/53051—68) Polarized electron cyclotron emission in the Tokapole II Tokamak.** Sengstacke, M.A.; Dexter, R.N.; Prager, S.C. (Wisconsin Univ., Madison (USA). Dept. of Physics). Jun 1984. Contract AC02-76ET53051. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014953.

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To examine the effect of wall reflections we have measured the polarization of second harmonic cyclotron emission (at omega = 2 omega/sub ce/) in the Tokapole II tokamak both with and without a microwave absorber installed within the field of view of the receiving antenna. Indeed, the local elimination of wall reflections markedly enhances the polarization, as described in section II. Section III describes observations consistent with right-hand cutoff effects and an attempt to infer the electron temperature from cyclotron emission in an optically thin plasma.

38933 **(GA-A—17576) Scaling of edge properties with main plasma parameters in Doublet III discharges.** Kahn, C.; Burrell, K.H.; Fairbanks, E.; Petrie, T.; Shimada, M.; Washizu, M.; Sengoku, S. (GA Technologies, Inc., San Diego, CA (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki). May 1984. Contract AT03-84ER51044;AT03-80SF11512. 23p. (CONF-840520—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013841.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

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Langmuir probes have been used extensively in Doublet III to diagnose edge and divertor plasma properties. Previous measure-

ments made by probe and thermocouple arrays in expanded boundary discharges have yielded estimates of neutralizer plate power loading, edge electron temperature and edge ion density. These successful diagnostic measurements have prompted both the extension of the arrays to cover almost the entire poloidal contour of Doublet III, and the installation of a movable, upper axis Langmuir probe. The enhanced system permits the diagnosis of the main plasma scrape-off layer and the plasma at the neutralizer plates. A second movable Langmuir probe has been used to determine the scaling of parameters in the divertor throat. Data from these and other diagnostics are presented. Divertor plate power loading, the effect of fluctuations and the scaling of edge plasma parameters are addressed. Profiles of plasma parameters across the main plasma scrape-off layer, the divertor throat and the divertor plates are also given.

38934 **(GA-A—17645) Physics of the H-mode.** Hinton, F.L.; Chu, M.S.; Dominguez, R.R.; Harvey, R.W.; Lao, L.L.; Lee, J.K.; Liu, C.S.; Moore, R.W.; Ohkawa, T.; Wong, S.K.; Lee, Y.C. (Maryland Univ., College Park (USA)). Jul 1984. Contract AT03-84ER53158. 11p. (CONF-840910—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014883.

From 10. international conference on plasma physics and controlled nuclear fusion research; London, UK (12 Sep 1984).

A theoretical picture of the H-mode is proposed, which explains some of the most important features of this good confinement mode in neutral beam heated plasmas with divertors. From a consideration of the transport through the separatrix and along the open field lines outside the separatrix, as well as the stability of the plasma inside the separatrix, we show that a bifurcation in the operating parameters is possible. At high edge temperatures, very large particle confinement times are possible because of the Ware pinch. The transport of particles and heat along the open field lines to the divertor region depends on temperature in a non-monotonic way, and the bifurcation of the thermal equilibrium which is implied may correspond to the L- to H-mode transition. The improvement of the interior confinement in the H-mode, when the edge temperature is higher, is shown to follow from the tearing mode stability properties of current profiles with pedestals.

38935 **(IAE—3683/7) Study on the ion spectra of plasmoids generated in the MK-500 powerful coaxial plasma accelerator.** Derbilov, V.I.; Sidnev, V.V.; Umrikhin, N.M.; Shevchenko, V.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84702539.

A technique of passive corpuscular diagnostics is described which is used for measuring ion spectra and determining most important parameters of a dense - (n approximately 10^{16} cm^{-3}) high-power (approximately 10 keV) plasmoid to a high degree of accuracy, with good temporal (approximately 0.2 μs) and spatial (approximately 1 mm) resolution. Direct measurements of the energy spectra of ion component of a plasmoid generated by the MK-500 powerful coaxial plasma injector are made. The measurements have revealed that the main plasma parameters lie within the ranges: plasmoid energy = 6 to 10 keV, ion temperature = 20 to 50 eV. Comparative analysis of the results of measurements conducted by means of the described technique with the MK-500 accelerator revealed good agreement with data of other diagnostics.

38936 (INIS-SU—236, pp 224-228) **Nuclear physics of thermonuclear fusion processes.** Kukulin, V.I.; Krasnopl'skij, V.M. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1983. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780474. (CONF-8210210—Pt.3).

From Conference on nuclear physics; Kharkov, Ukrainian SSR (4 Oct 1982).

Nuclear-physical aspects of thermonuclear fusion processes are discussed. One is considered the problem of measurements and theoretical extrapolations of cross sections for very low-energy nuclear reactions, the problem of advanced thermonuclear fuels and the concept and application of chain catalytic reactions. Also the nuclear-physical aspects of blanket reactions and plasma diagnostics are described.

38937 **(LA-UR—84-1976) Two novel plasma diagnostic tools: fiber sensors and phase conjugation.** Jahoda, F.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 26p. (CONF-840616—18). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014033.

From International conference on plasma physics; Lausanne, Switzerland (27 Jun 1984).

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A rapidly developing technology (single-mode optical fiber sensors) and recent fundamental research in nonlinear optics (phase conjugation) both offer opportunities for novel plasma diagnostics. Single-mode fiber sensors can replace electrical wire probes for current and magnetic field measurements with advantages in voltage insulation requirements, electromagnetic noise immunity, much greater bandwidth, and some configuration flexibility. Faraday rotation measurements through fibers wound on the ZT-40M RFP have demonstrated quantitative results, but competing linear birefringence effects still hinder independent interpretation. Optical phase conjugation (in which a phase reversed copy of a laser beam is generated) allows real time distortion corrections in laser diagnostics. Self-pumped phase conjugation in $BaTiO_3$ improves the quality of phase conjugation imagery and greatly simplifies experimentation directed toward plasma diagnostics. Our initial applications are (a) time-differential refractometry with high spatial resolution and (b) intracavity absorption Zeeman spectroscopy.

38938 **(LBL—17976) Lie-transformed action principle for classical plasma dynamics.** Kaufman, A.N. (Lawrence Berkeley Lab., CA (USA)). Jun 1984. Contract AC03-76SF00098. 6p. (CONF-8405168—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014576.

From International colloquium on group theoretical methods in physics; College Park, MD, USA (21 May 1984).

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The Lie transform for a single particle in a wave is embedded in a Lagrangian action principle for self-consistent plasma dynamics. Variation of the action then yields the Vlasov equation for the oscillation-center distribution, the ray equations and amplitude transport for the wave, and the Poisson equation for the quasistatic field.

38939 **(PPPL—2111) Three caveats for linear stability theory: Rayleigh-Benard convection.** Greenside, H.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1984. Contract AC02-76CH03073. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015157.

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Recent theories and experiments challenge the applicability of linear stability theory near the onset of buoyancy-driven (Rayleigh-Benard) convection. This stability theory, based on small perturbations of infinite parallel rolls, is found to miss several important features of the convective flow. The reason is that the lateral boundaries have a profound influence on the possible wave numbers and flow patterns even for the largest cells studied. Also, the nonlinear growth of incoherent unstable modes distorts the rolls, leading to a spatially disordered and sometimes temporally nonperiodic flow. Finally, the relation of the skewed varicose instability to the onset of turbulence (nonperiodic time dependence) is examined. Linear stability theory may not suffice to predict the onset of time dependence in large cells close to threshold.

38940 **(PPPL—2113) Fast scanning heterodyne receiver for the measurement of the time evolution of the electron temperature profile on TFTR.** Taylor, G.; Efthimion, P.; McCarthy, M.; Arunasalam, V.; Bitzer, R.; Bryer, J.; Cutler, R.; Fredd, E.; Goldman, M.A.; Kaufman, D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1984. Contract AC02-76CH03073. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015156.

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Two fast scanning heterodyne receivers, swept between 75 to 110 GHz and 110 to 170 GHz in 2 msec every 4 msec, were developed to measure the electron cyclotron emission on the horizontal midplane of the Tokamak Fusion Test Reactor (TFTR) plasma. An absolute, in situ calibration technique enables the determination of the profile of the plasma electron temperature from the cyclotron emission intensity. The 4 msec repetition rate of the receiver allowed the resolution of sawtooth fluctuations of temperature, whose period was 10 to 100 msec, in profiles with central temperatures of 1 to 2.5 keV.

38941 **(PPPL—2115) Trapped particle destabilization of the internal kink mode.** White, R.B.; Chen, L.; Romanelli, F.; Hay, R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1984. Contract AC02-76CH03073. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015150.

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The internal kink mode is destabilized by trapped high energy particles, leading to a new branch of the internal kink dispersion relation with a real frequency near the average trapped particle precession frequency and a growth rate of the same magnitude. This trapped particle branch of the dispersion relation is investigated numerically for a variety of particle distributions. Mode growth rate and frequency are found as a function of plasma β, density, and trapped particle energy and distribution. The high energy trapped particle sources considered are neutral beam injection, ion cyclotron heating, and fusion alpha particles. Relevance for various plasma heating schemes is discussed.

38942 **(PPPL—2116) Harmonic generation and parametric decay in the ion cyclotron frequency range.** Skiff, F.N.; Wong, K.L.; Ono, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1984. Contract AC02-76CH03073. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015147.

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Harmonic generation and parametric decay are examined in a toroidal ACT-I plasma using electrostatic plate antennas. The harmonic generation, which is consistent with sheath rectification, is sufficiently strong that the nonlinearly generated harmonic modes themselves decay parametrically. Resonant and nonresonant parametric decay of the second harmonic are observed and compared with uniform pump theory. Resonant decay of lower hybrid waves into lower hybrid waves and slow ion cyclotron waves is seen for the first time. Surprisingly, the decay processes are nonlinearly saturated, indicating absolute instability.

38943 **(PPPL—2118) H-modes studies in PDX.** Fonck, R.J.; Beirsdorfer, P.; Bell, M.; Bol, K.; Boyd, D.; Buchenauer, D.; Budny, R.; Cavallo, A.; Couture, P.; Crowley, T. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1984. Contract AC02-76CH03073. 30p. (CONF-840311—14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015148.

From 4. international symposium on heating in toroidal plasmas; Rome, Italy (21 Mar 1984).

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A regime of enhanced energy confinement during neutral beam heating has been obtained routinely in the PDX tokamak after modifications to form a closed divertor geometry. Plasma density profiles were broad and the electron temperature at the plasma edge reached values of $\sim$ 400 eV in the H-mode phase of a discharge. A comparison of closed divertor discharges with moderate and intense gas puffing indicates that a requirement for obtaining high confinement times is the localization of the plasma fueling source in the divertor throat region. While high confinement was attained at moderate injected powers (P/sub INJ/ $\leq$ 3 MW), confinement was degraded at higher powers due to both increased edge instabilities and, especially, the intense gas puffing needed to prevent disruptions. Initial results with a particle scoop limiter indicate high particle confinement times and energy confinement times approaching those of diverted H-mode plasmas.

38944 **(PPPL—2121) Tilt and shift mode stability in a spheromak with a flux core.** Finn, J.M.; Jardin, S.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1984. Contract AC02-76CH03073. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015149.

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The stability of spheromak equilibria with a flux core, or reversal coil, is studied by means of an ideal MHD code. Results depend critically upon whether the flux hole region (the current free area just inside the separatrix) is treated as perfectly conducting plasma or as vacuum. This indicates that the tilt and shift modes persist as resistive instabilities if they are stable in ideal MHD. Specifically, for nonoptimally shaped equilibria, the flux core must nearly touch the current channel if the flux hole is vacuum, whereas the core may be slightly outside the separatrix if the flux hole has conducting plasma. A larger margin exists for optimally shaped equilibria.

38945 **(PPPL—2122) Relativistic effects on cyclotron wave absorption by an energetic electron tail in the PLT tokamak.** Mazzucato, E.; Efthimion, P.; Fidone, I. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jul 1984. Contract AC02-76CH03073. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015144.

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Electron cyclotron wave absorption by mildly relativistic electrons in the low density regime of the PLT tokamak is investigated. Appreciable wave damping is found for vertical propagation at frequencies of 50, 60, and 70 GHz when the spatially constant cyclotron frequency is 89 GHz. The perpendicular temperature T/ sub perpendicular/(v/sub parallel/) of the fast tail is also measured from emission of radiation in the same direction. The results obtained are in satisfactory agreement with the theory of wave emission and absorption.

38946 **(PPPL—2127) Influence of hot beam ions on MHD ballooning modes in tokamaks.** Rewoldt, G.; Tang, W.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1984. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015146.

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It has recently been proposed that the presence of high energy ions from neutral beam injection can have a strong stabilizing effect on kinetically-modified ideal MHD ballooning modes in tokamaks. In order to assess realistically the importance of such effects, a comprehensive kinetic stability analysis, which takes into account the integral equation nature of the basic problem, has been applied to this investigation. In the collisionless limit, the effect of adding small fractions of hot beam ions is indeed found to be strongly stabilizing. On the other hand, for somewhat larger fractions of hot ions, a new beam-driven mode is found to occur with a growth rate comparable in magnitude to the growth rate of the MHD ballooning mode in the absence of hot ions. This implies that there should be an optimal density of hot particles which minimizes the strength of the relevant instabilities. Employing non-Maxwellian equilibrium distribution functions to model the beam species makes a quantitative, but not qualitative, difference in the results. Adding collisions to the calculation tends to reduce considerably the stabilizing effect of the hot ions.

38947 **(SAI—84/3053) Aspects of turbulence in nonlinear systems. Progress report.** Frieman, E.A.; Hagan, W.K. (Science Applications, Inc., La Jolla, CA (USA)). May 1984. Contract AC03-84ER13174. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013298.

Progress has been made on the following 2 tasks: (1) relate the various nonlinear extensions of the finite gyroradius theory, and (2) derive and understand these theories in the context of contemporary Hamiltonian dynamics. In addition, new nonlinear work was

also done and this work is also compared to other nonlinear theories. (MOW)

38948 **(UCRL—90902) Local fields in strongly coupled plasmas.** Pollock, E.L.; Weisheit, J.C. (Lawrence Livermore National Lab., CA (USA)). Jun 1984. Contract W-7405-ENG-48. 29p. (CONF-8406153—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84013375.

From 7. international conference on spectral line shapes; Aussois, France (11 Jun 1984).

Computer simulation techniques and important static properties of plasma microfields are discussed. The relevant timescales are introduced for dynamical atomic problems, and some time-dependent properties of microfields are discussed. In the last two sections of the paper these results are applied to two problems relevant to the spectroscopy of dense plasmas: (1) broadening of spectral lines, and (2) screening in inelastic electron-ion collisions.

38949 **Observation of lines above 2000 A in O VIII and C VI in the Princeton Large Torus due to charge-exchange processes: Diagnostic applications.** Suckewer, S.; Skinner, C.H.; Stratton, B.; Bell, R.; Cavallo, A.; Hosea, J.; Hwang, D.; Schilling, G. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Applied Physics Letters;* **45**: No. 3, 236-238(1 Aug 1984). Contract AC02-76CH03073.

Hydrogenlike oxygen and carbon lines from transitions ($\Delta n = 1$) between levels of high principal quantum number n, with wavelengths above 2000 A have been observed. Observations of such transitions were possible due to charge-exchange processes during neutral beam injection of hydrogen atoms into the Princeton Large Torus tokamak. The lines are O VIII 2976 A (8—7 transitions), C VI 3434 A (7—6), and C VI 5291 A (8—7). Application of these lines for ion temperature measurements and initial observations of neutral beam vertical distributions in the plasma are presented.

38950 **Stability of the radial electric field in a nonaxisymmetric torus.** Shaing, K.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **27**: No. 7, 1567-1569(Jul 1984). Contract W-7405-ENG-26.

The stability of the radial electric field in a nonaxisymmetric torus is discussed from the thermodynamic point of view. It is found that for both radially local and nonlocal models, the stable radial electric field is at the minimum of the generalized heat production rate. A similarity between the local model and the liquid—gas phase transition is pointed out.

38951 **Experimental and theoretical studies of the effects of nonuniformities in nonequilibrium magnetohydrodynamic flows.** Lytle, J.K.; Louis, J.F. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **27**: No. 7, 1624-1631(Jul 1984). Contract AC01-79ET15518.

A study of wake nonuniformities in a nonequilibrium magnetohydrodynamic plasma is described. Experimental results are presented from an electrodeless disk-shaped channel in both radial flow and swirl flow configurations. The experimental conditions are analyzed with a nonequilibrium plasma model that accounts for variations in the wake gas properties and wake width. The results show that the wake nonuniformities in the radial flow channel are weak, but in the swirl flow channel they are strong because of an instability. This instability is a consequence of the wake orientation. Furthermore, the intensity of the nonuniformity in an unstable plasma is dependent upon the wake gas velocity and wake width.

38952 **Growth rates of parametric instabilities driven by two pumps.** Milovich, J.L.; Fried, B.D.; Morales, G.J. (Department of Physics, University of California, Los Angeles, Los Angeles, California 90024). *Physics of Fluids;* **27**: No. 7, 1647-1658(Jul 1984). Contract AM03-76SF00010.

The parametric instability growth rate of ion-acoustic and Langmuir waves, driven unstable by two uniform pumps near the Bohm—Gross frequency, is calculated as a function of pump amplitudes and frequencies. Two instability mechanisms can be identified: one corresponds to the usual, single pump parametric instabilities (decay and oscillating two stream), while the other is similar to that found in the Mathieu equation. The interaction between these two mechanisms results in a nonmonotonic dependence of the growth rate on the pump amplitudes and frequencies: both cancellation and enhancement are obtained for various values of the parameters. An analytic study of the relevant dispersion relation using Hill's method is complemented by numerical studies in both the frequency and time domains.

38953 **Electron-cyclotron maser and whistler instabilities in a relativistic electron plasma with loss cone distribution.** Tsang, K. (Science Applications, Inc., Plasma Research Institute, Boulder, Colorado 80302). *Physics of Fluids;* **27**: No. 7, 1659-1664(Jul 1984). Contract AC03-76ET53057.

The electron-cyclotron maser and whistler instabilities are investigated in a unified treatment. The dispersion relation is solved numerically and extensive parametric studies are performed. It is found that growth rates for both instabilities increase with perpendicular hot electron temperature and the size of the loss cone.

38954 **Plasma resistivity in the presence of a reversed-field pinch dynamo.** Schoenberg, K.F.; Moses, R.W. Jr.; Hagenson, R.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 7, 1671-1676(Jul 1984).

A global calculation of reversed-field pinch (RFP) plasma resistivities, eta/sup w//sub parallel/ and eta/sup k//sub parallel/, based on power balance and magnetic helicity balance, respectively, is discussed. For reasonable RFP beta values ($\beta < 0.1$), eta/sup k//sub parallel/ provides an estimate of plasma resistivity parallel to the magnetic field, and agrees with the Spitzer resistivity within a factor of two. The expression (1-eta/sup k//sub parallel//eta/sup w//sub parallel/) indictes the fraction of ohmic heating power absorbed by fluctuations in the discharge. An examination of 180 kA discharges on the Los Alamos ZT-40M experiment suggests that approximately one-third of the ohmic heating power drives fluctuations, including the dynamo effect, during discharge sustainment.

38955 **Analytic solutions of del x B = λB having separatrices for geometries with one ignorable coordinate.** Turner, L. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 7, 1677-1685(Jul 1984).

Analytic solutions of del x B = λB are presented for PS-1 and CTX types of spheromaks, and for the proposed Wisconsin reversed-field pinch. Inherent in the spheromak solutions is a separatrix that separates a region of closed magnetic field lines from a surrounding region of open ones. Such a structure enhances the plausibility of maintaining steady-state spheromak operation by driving a steady current along the open field lines.

38956 **Stochastic E x B particle transport.** Kleva, R.G.; Drake, J.F. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **27**: No. 7, 1686-1698(Jul 1984).

The E x B particle guiding center motion caused by two propagating electrostatic waves is investigated. Particle motion is stochastic if three criteria are met: (1) the phase velocities of the two waves are not equal, (2) the E x B drift velocities generated by each wave are nearly the same, and (3) the total E x B drift velocity is larger than the phase velocity of each wave. Particle transport in the stochastic regime is distinguished by three important characteristics: (1) the diffusion coefficient is virtually independent of the electric field fluctuation amplitude E at large E, (2) particle transport is generated only by waves which produce nearly commensurate E x B drifts, and (3) the velocity correlation time does not depend on E, but rather on the wave periods. The physical mechanism underlying stochastic particle transport is discussed. At large E the transport is dominated by a small group of particles which make long jumps along the separatrix of the potential contours of the waves.

38957 Reformulation of lower-hybrid wave propagation and absorption. Grossmann, W.; Weitzner, H. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012). *Physics of Fluids;* **27**: No. 7, 1699-1703(Jul 1984). Contract AC02-76ER03077.

A full wave solution of the propagation and resonant absorption of lower-hybrid waves in an inhomogeneous plasma using the cold plasma model is carried out and compared with results obtained in an infinite homogeneous plasma medium. It is found that the density gradient coupled to finite poloidal model number allows the lower-hybrid wave to reach the hybrid layer for the case of purely perpendicular propagation. Such a wave is evanescent in the infinite homogeneous plasma. The analysis also shows that, for the cold plasma model, roughly equal amounts of energy are absorbed by the ions and electrons in the resonant layer. The analysis may have some bearing on the experimental efforts to propagate lower-hybrid waves into the interior of tokamak plasmas.

38958 Density threshold for parametric instability of lower-hybrid waves in tokamaks. Liu, C.S.; Tripathi, V.K.; Chan, V.S.; Stefan, V. (GA Technologies Inc., San Diego, California 92138). *Physics of Fluids;* **27**: No. 7, 1709-1717(Jul 1984). Contract AT03-76ET51011.

Lower-hybrid waves of finite wavenumber in a tokamak are susceptible to parametric instabilities when a certain threshold in density and power is exceeded. For typical tokamak temperatures, the channel of decay with a large growth rate is found to be due to the nonlinear ion-cyclotron damping of the beat wave generated by the pump and the lower-hybrid sideband. We furthermore compute the spectrum of the sideband at ω_0-nω/sub c/i through the nonlinear cascade of parametric interaction. The resonant decay into ion-cyclotron waves is also considered and shown to have a lower density threshold close to the critical density above which there is no current drive and occurs preferentially in a narrow region near the edge.

38959 Magnetic coordinates for equilibria with a continuous symmetry. Dewar, R.L.; Monticello, D.A.; Sy, W.N. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **27**: No. 7, 1723-1732(Jul 1984). Contract AC03-76SF00098.

Magnetic coordinates for hydromagnetic equilibria are defined which treat toroidal and "straight" helical plasmas equivalently and yet exploit the existence of a continuous symmetry to derive relations between various geometrical and physical qualities. This allows the number of equilibrium quantities which must be known to be reduced to a minimal, or primitive, set. Practical formulas for various quantities required in hydromagnetic stability calculations (interchange, ballooning, and global) are given in terms of this primitive set.

38960 Low mode number stability of a quadrupole tandem mirror. Phillips, M.W.; Callen, J.D. (Nuclear Engineering Department, University of Wisconsin-Madison, Madison, Wisconsin 53706). *Physics of Fluids;* **27**: No. 7, 1733-1737(Jul 1984). Contract AC02-80ER53104.

The low mode number macroscopic stability of plasmas in the Phaedrus tandem mirror is studied. The stability analysis includes finite Larmor radius effects and takes into account the nonaxisymmetric nature of the equilibrium. A variational principle is formulated which is solved for the normal modes of the system by a Rayleigh—Ritz method. Despite the full 3-D representation of the modes and nonaxisymmetry of the equilibrium it is found that for values of rho/sub i//R/sub p/>0.05 the most unstable modes are to a large extent composed of a single poloidal Fourier (m) component. For the Phaedrus tandem mirror experiment the most unstable mode is an m = 1 rigid displacement.

38961 Equilibrium modeling of ISX-B tokamak discharges. Charlton, L.A.; Wieland, R.M.; Neilson, G.H. (Computer Science Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **27**: No. 7, 1738-1742(Jul 1984). Contract W-7405-ENG-26.

Poloidal magnetic measurements of the multipole moments of the toroidal current density and of the external multipole fields provide information on the current profile in ISX-B. This can be used to prescribe a form for the current profile which produces an equilibrium consistent with profile measurements, magnetic data, and the q = 1 surface. This procedure has been applied satisfactorily in a number of cases, several of which are presented here.

38962 Ion skin depth scaling and cusp distortion in picket fence geometry. Ratliff, S.T.; Dawson, J.M. (Lockheed-California Company, Burbank, California 91520). *Physics of Fluids;* **27**: No. 7, 1743-1749(Jul 1984). Contract AM03-76SF00010.

Computer simulations show that when a low-frequency (ω = 0 in the simulations) external electric field is applied to a cusp-confined plasma, some of the electrons are trapped by the cusp fields, and the ions do a significant amount of shielding of the external E field (skin effect). The effect of varying the cusp spacing relative to the ion collisionless skin depth on cusp distortion, electron current, and ion current was also studied.

38963 Electron ring startup model for ELMO Bumpy Torus. Hamasaki, S.; Krall, N.A.; Sperling, J.L. (JAYCOR, San Diego, California 92138). *Physics of Fluids;* **27**: No. 7, 1759-1772(Jul 1984).

The microwave power requirements for EBT electron ring startup are calculated based on the assumption that the ring electrons originate as runaways accelerated by the first harmonic resonance of the extraordinary mode. The calculated microwave power threshold for startup is consistent with the experimental data for the microwave power requirements deduced from the C—T transition points. The ring model is also compatible with the experimentally observed ring location if the subsequent heating and toroidal drift motion of the energetic electron after the initial startup is considered in determining the ring spatial structure.

38964 Nonlinear evolution of the resistive interchange mode in the cylindrical spheromak. DeLucia, J.; Jardin, S.C. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **27**: No. 7, 1773-1784(Jul 1984). Contract AC02-76CH03073.

Results are presented of a study of various aspects of the single helicity nonlinear development of the resistive interchange mode in the cylindrical spheromak. A formulation of the helically symmetric resistive magnetohydrodynamic (MHD) equations that partially separates the ideal MHD characteristics is developed. Mode saturation can occur because of the quasilinear flattening of the pressure profile in the vicinity of the mode rational surface. However, this saturation process is defeated when the plasma overheats and in regions of the plasma where the shear is low. Finite fluid compression has significant, and optimistic, consequences on the long-term nonlinear behavior of this mode. For a tearing mode stable cylindrical spheromak equilibrium configuration with an axial beta value of 6%, complete overlap of the m = 1 islands occurs in about 3% of the resistive skin time for a magnetic Reynolds number of $S = 10^5$. For typical parameters of the S-1 device at Princeton, this time corresponds to nearly one millisecond.

38965 Tilt stability of arbitrary aspect ratio ion rings. Ruchti, C.B.; Lovelace, R.V. (Department of Applied and Engineering Physics, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* **27**: No. 7, 1789-1795(Jul 1984). Contract AC02-76CH03073;AC02-76ET53017.

A study is made of the low-frequency tilt stability of finite aspect ratio field-reversed ion rings. A new analytic-numerical method is described which overcomes the large-aspect-ratio assumption of previous analytical treatments. The method involves the numerical evaluation of the Vlasov time history integrals for the ring particles using orbits determined numerically in numerically calculated self-consistent equilibria. The method is applied to the tilt stability of fat, noncircular cross-section rings. The condition for tilt instability is found to be of the form ω/sub z/>kΩ, where the parameter k varies from 0.7 to 1.0 for the cases studied, and where ω/sub z/ is the mean axial betatron frequency and Ω is the mean toroidal circulation frequency. For weak rings (field-reversal factor δ = B/sub self//B/sub e/x< or =1), k approaches unity, whereas for strong rings (δroughly-equal2), kroughly-equal0.7. As a given ring is elongated axially it is found that ω/sub z/ decreases, while

Ω changes relatively little. A saturation mechanism is proposed whereby tilt unstable rings reach a stable equilibrium through axial lengthening.

38966 Stimulated Brillouin scattering in inhomogeneous flowing plasma. Berger, R.L. (KMS Fusion, Inc., Ann Arbor, Michigan 48106). *Physics of Fluids;* 27: No. 7, 1796-1803(Jul 1984). Contract AC08-82DP40152.

The threshold, growth rate, and convective amplification of stimulated Brillouin scattering are found in an inhomogeneous flowing plasma for obliquely incident laser light. Absolutely unstable modes exist for special combinations of wave vectors that correspond to forward scattering in a supersonically flowing plasma. Some of the analysis is shown to apply to stimulated Raman scattering at a density extrema. For parameters of interest to laser fusion, these thresholds are lower than for stimulated backscattering in a density gradient.

38967 Nonlinear space-charge wave propagation on thin annular electron beams. Fenstermacher, D.L.; Seyler, C.E. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* 27: No. 7, 1808-1814(Jul 1984). Contract AC02-80ER10569.

A warm fluid description of a relativistic thin annular electron beam is used to investigate large amplitude space-charge waves for currents up to the space-charge limit. The beam is centered within a conducting cylindrical boundary and is guided by a strong magnetic field in vacuum. Exact steady-state periodic and solitary wave solutions are found numerically up to the breaking amplitude and are characterized by nonlinear wave velocities which vary significantly from linear phase velocities for currents > or ≈0.7I/sub L/. A time-dependent pseudospectral code was developed and used to understand the dynamics of nonlinear wave interactions. The general character of these waves is to propagate as a stable superposition of solitary waves whose interactions are nearly elastic and preserve the coherence and form of the waves. The advantages of thin annular beams and the detrimental effects of warm beams are discussed. Recommendations are given concerning the amplitude, frequency, wavelength, and beam temperature of nonlinear waves for potential use in collective acceleration experiments.

38968 Linear longitudinal oscillations in collisionless plasma diodes with thin sheaths. Part I. Method. Kuhn, S. (Plasma Theory and Simulation Group, Electronics Research Laboratory, University of California, Berkeley, California 94720). *Physics of Fluids;* 27: No. 7, 1821-1833(Jul 1984). Contract AT03-76ET53064.

A method is proposed for treating linear longitudinal perturbations in one-dimensional collisionless plasma diodes with a uniform plasma region and thin electrode sheaths. The method is comprehensive in that it allows for very general equilibrium, initial, boundary, and external-circuit conditions. Upon Laplace-transforming the Vlasov and Poisson equations in both space and time, appropriate evaluation of all pertinent relations leads to a set of 2+2n/sub sigma/(n/sub sigma/ is the number of particle species) coupled integral equations in x and v for the following quantities (which are the time Laplace transforms of the respective physical perturbations): j/sub e/(ω) (external-circuit current density), E(x,ω) (electrostatic field), f/sup sigma//sub l/(v>0,ω), and f/sup sigma//sub r/(v<0,ω) (velocity distribution functions of the plasma-bound particles at the left- and right-hand plasma boundaries, respectively), where σ is the species index. The formal solution of these integral equations and the inverse Laplace transformation (ω→t) are discussed in general terms. In particular, it is shown that the intrinsic eigenfrequencies are given by the zeros of the coefficient determinant of the integral equations. A comparison with previous treatments is given, and it is concluded that extensions of the method proposed to more general systems should be feasible.

38969 Linear longitudinal oscillations in collisionless plasma diodes with thin sheaths. Part II. Application to an extended Pierce-type problem. Kuhn, S. (Plasma Theory and Simulation Group, Electronics Research Laboratory, University of California, Berkeley, California 94720). *Physics of Fluids;* 27: No. 7, 1834-1851(Jul 1984). Contract AT03-76ET53064.

The integral-equation method developed in Part I is applied to a Pierce-type diode [J. Appl. Phys. 15, 721 (1944)] whose external circuit involves a resistor, an inductor, and a signal generator. The general linear perturbational problem is solved analytically for the small-amplitude quantities j/sub e/(t) (external-circuit current density) and E(x, t) (electrostatic field). Each of these quantities can be constructed from a "spatial" Green's function (accounting for initial perturbations of the plasma), a "temporal" Green's function (accounting for external-generator signals), and two functions associated with the initial state of the external circuit. The solutions generally exhibit an initial transient and an asymptotic part, the latter being a superposition of eigenmodes only. Systematic numerical results for eigenfrequencies and eigenmode profiles in some typical parameter regions demonstrate that the linear response and stability behavior of the diode system may substantially depend on the properties of the external circuit.

38970 Electromagnetic ion beam instabilities. Gary, S.P.; Smith, C.W.; Lee, M.A.; Goldstein, M.L.; Fooslund, D.W. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* 27: No. 7, 1852-1862(Jul 1984).

The linear theory of electromagnetic instabilities driven by an energetic ion beam streaming parallel to a magnetic field in a homogeneous Vlasov plasma is considered. Numerical solutions of the full dispersion equation are presented. At propagation parallel to the magnetic field, there are four distinct instabilities. A sufficiently energetic beam gives rise to two unstable modes with right-hand polarization, one resonant with the beam, the other nonresonant. A beam with sufficiently large T/sub perpendicular//T/sub parallel/ gives rise to the left-hand ion cyclotron anisotropy instability at relatively small beam velocities, and a sufficiently hot beam drives unstable a left-hand beam resonant mode. The parametric dependences of the growth rates for the three high beam velocity instabilities are presented here. In addition, some properties at oblique propagation are examined. It is demonstrated that, as the beam drift velocity is increased, relative maxima in growth rates can arise at harmonics of the ion cyclotron resonance for both right and left elliptically polarized modes.

38971 Preionization and start-up in the ISX-B tokamak using electron cyclotron heating at 28 GHz. Kulchar, A.G.; Eldridge, O.C.; England, A.C.; Bush, C.E.; Edmonds, P.H.; Kelley, G.G.; Loring, C.M.; Peng, Y.M.; Wilgen, J.B.; Borowski, S.K. (The University of Tennessee, Knoxville, Tennessee 37917). *Physics of Fluids;* 27: No. 7, 1869-1879(Jul 1984). Contract W-7405-ENG-26.

A 28-GHz gyrotron is used to produce a plasma at the electron cyclotron resonance in the Impurity Study Experiment (ISX-B) tokamak. The influence of the toroidal magnetic field magnitude, error fields, gas pressure, microwave power, microwave pulse length, and microwave timing is studied for experiments with magnetic field and gas only. Also, experiments with preionization followed by capacitor discharges are carried out in which these quantities are varied, as are the capacitor bank voltages. Optimum conditions of preionization for some of the parameters are determined. A theoretical model that adequately reproduces the data is given. Calculations based on this model show the temporal evolution of the electron temperature and density, the neutral density, and the plasma current. The model adequately accounts for present and previous experimental results and can be used to make predictions for future experiments. The decay of the discharge with no input power is not correctly predicted by the model.

38972 Stimulated Raman scattering, two-plasmon decay, and hot electron generation from underdense plasmas at 0.35 μm. Figueroa, H.; Joshi, C.; Azechi, H.; Ebrahim, N.A.; Estabrook, K. (University of California, Los Angeles, California 90024). *Physics of Fluids;* 27: No. 7, 1887-1896(Jul 1984). Contract AC08-80DP40124.

Experimental studies of stimulated Raman back and side scattering, two-plasmon decay, and the generation of high-energy electrons in 0.35 μm laser plasma interaction are presented. To isolate the various phenomena occurring at different densities, we have attempted to control the maximum plasma density by varying

the thickness of the foil targets. The scattered light frequency is used as a diagnostic to measure the peak plasma density. Time integrated and time resolved scattered spectra for variable plasma densities are discussed. Effects of self-generated magnetic fields and plasma temperature on SRS and 2ω/sub p/ decay, respectively, are examined as possible mechanisms responsible for splitting of the backscattered spectrum at $\omega_0/2$. A discussion of the effects of a parabolic density profile on the SRS threshold is also included. Finally, the measured energy and angular distribution of the high-energy electrons are discussed. Two-plasmon decay is suggested as the probable mechanism generating the hot electrons.

38973 **Solitons versus parametric instabilities during ionospheric heating.** Nicholson, D.R.; Payne, G.L.; Downie, R.M.; Sheerin, J.P. (Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242). *Physical Review Letters;* **52**: No. 24, 2152-2155(11 Jun 1984). Contract AC02-82ER53136.

Ionospheric heating is studied by numerical solution of the modified Zakharov equations for typical ionospheric heating parameters. It is shown that modulational instability followed by soliton formation can be more important than the previously considered parametric decay instability.

38974 **Chaotic nonlinear stimulated Brillouin scattering.** Randall, C.J.; Albritton, J.R. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **52**: No. 21, 1887-1890(21 May 1984). Contract W-7405-ENG-48.

Stimulated Brillouin scattering is analyzed in finite systems which have a boundary reflective to light. The linear instability is considerably altered from that for the usual transmitting boundaries. In the nonlinear regime the scattered light intensity may behave chaotically in time and exhibit rich frequency spectra including shifts corresponding to fractional harmonics of the fundamental acoustic wave. Simulation results compare favorably with data from laser-plasma—interaction experiments.

38975 **Electron temperature measurements in the field-reversed configuration experiment FRX-C.** Rej, D.J.; Armstrong, W.T. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **24**: No. 2, 177-182(Feb 1984).

Electron temperature data are presented from Thomson scattering measurements performed on field-reversed configuration plasmas generated in the FRX-C experiment. Two experimental conditions have been investigated, corresponding to initial deuterium fill pressures of 5 and 20 mtorr. At 5 mtorr, Tsub(e) values of (175+-25) eV are observed, which are nearly independent of time and radial position inside the separatrix. An electron power loss of approximately 80 MW is inferred. At 20 mtorr, Tsub(e) values of 70-120 eV are measured and good agreement with radial pressure balance is obtained. This agreement indicates that radiation from low-Z impurity ions does not dominate the observed energy confinement.

38976 **Ultrafast gated intensifier design for laser fusion X-ray framing applications.** Price, R.H.; Cook, W.M.; Kalibjian, R.; Thomas, S.W.; Wiedwald, J.D. (Lawrence Livermore Nat'l. Lab., P.O. Box 5508, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 504-508(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A major challenge for laser fusion is the study of the symmetry and the hydrodynamic stability of imploding fuel capsules. Streaked x-radiography, in one space and one time dimension, does not provide sufficient information. Two (spatial) dimensional frames of 10-100 ps duration are required with good image quality, minimum geometrical distortion (approximately 1%), dynamic range greater than 1000 and greater than 200 X 200 pixels. A gated transmission line imager (TLI) can meet these requirements with frame times between 30 and 100 ps. An instrument of this type is now being developed. Progress on this instrument including theory of operation, ultrafast pulse generation and propagation, component integration, and high resolution phosphor screen development are presented.

38977 **System and method for generating current by selective electron heating.** Fisch, N.J.; Boozer, A.H. (to U.S. of America as represented by the U.S. Dept. of Energy, Washington, DC). US Patent 4,425,295. 10 Jan 1984. Filed date 9 Feb 1981. vp.

PAT-APPL-233296.

A system for the generation of toroidal current in a plasma which is prepared in a toroidal magnetic field. The system utilizes the injection of high-frequency waves into the plasma by means of waveguides. The wave frequency and polarization are chosen such that when the waveguides are tilted in a predetermined fashion, the wave energy is absorbed preferentially by electrons traveling in one toroidal direction. The absorption of energy in this manner produces a toroidal electric current even when the injected waves themselves do not have substantial toroidal momentum. This current can be continuously maintained at modest cost in power and may be used to confine the plasma. The system can operate efficiently on fusion grade tokamak plasmas.

38978 **Energy confinement scaling in tokamaks: some implications of recent experiments with ohmic and strong auxiliary heating.** Goldston, R.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Plasma Physics;* **26**: No. 1, 87-103(Jan 1984). (CONF-830908—).

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

Recent results from confinement scaling experiments on tokamaks with ohmic and strong auxiliary heating are reviewed. An attempt is made to draw these results together into a "low-density" ohmic confinement scaling law, and a scaling law for confinement with auxiliary heating. The auxiliary heating confinement law may also serve to explain the saturation in tausub(E) vs. n-barsub(e) observed in some ohmic heating density scaling experiments.

38979 **Status of tandem mirror confinement.** Baldwin, D.E. (Lawrence Livermore National Lab., CA (USA)). *Plasma Physics;* **26**: No. 1, 227-236(Jan 1984). (CONF-830908—).

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

Recent end-stopping experiments in TMX-Upgrade show strong plugging of the central cell by lower-density plugs, requiring both electron-cyclotron heating (ECRH) and 47° neutral-beam injection, consistent with the thermal barrier concept. These experiments have low density ($n < 10^{12}$ cm^{-3}) due to inefficient ECRH power coupling. Hot ion and hot electron buildup are consistent with Fokker-Planck calculations. No ion cyclotron activity is observed in the plugs; occasional electron cyclotron activity is observed. With plugging, axial lifetimes (tausub(parallel to) > 40 ms) are larger than radial (tausub(perpendicular to) = 5-10 ms) due to observed non-ambipolar ion transport. Recent tandem mirror theoretical activities are also surveyed.

38980 **Preliminary results of electron cyclotron heating experiments on the PDX tokamak.** Hsuan, H.; Polman, R.; Boyd, D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Plasma Physics;* **26**: No. 1, 265-267(Jan 1984). (CONF-830908—).

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

ECH experiments on PDX have been carried out with two 60GHz pulsed gyrotrons at about 100kW each. The electron cyclotron (EC) waves were launched in narrow beams from both outside and inside the plasma torus. In the best heating results obtained, Thomson scattering data recorded a central temperature increase from <=1.5keV to >=2.5keV at about 10^{13}cm^{-3} density with approximately 80kW outside ordinary mode heating.

38981 **TFTR initial operations.** Young, K.M.; Bell, M.; Blanchard, W.R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Plasma Physics;* **26**: No. 1, 11-22(Jan 1984). (CONF-830908—).

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

TFTR (Tokamak Fusion Test Reactor) has operated since December 1982 with ohmically heated plasmas. Routine operation

with feedback control of plasma current, position and density has been obtained for plasmas with Isub(p) approx.= 800 kA, a = 68 cm, R = 250 cm, and Bsub(t) = 27 kG. A maximum plasma current of 1 MA was achieved with q approx.= 2.5. Energy confinement times of approx. 150 msec were measured for hydrogen and deuterium plasmas with n-barsub(e) approx.= 2 x 10^{13} cm^{-3}, Tsub(e)(O) approx.= 1.5 keV, Tsub(i)(O) approx.= 1.5 keV and Zsub(eff) approx.= 3. The preliminary results suggest a size-cubed scaling from PLT, and are consistent with Alcator C scaling where tau approx. nR^2a. Initial measurements of plasma disruption characteristics indicate current decay rates of approx. 800 kA in 8 ms which is within the TFTR design requirement of 3 MA in 3 ms.

38962 **Review of experiments on current drive in tokamaks by means of RF waves.** Hooke, W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Plasma Physics;* **26**: No. 1, 133-144(Jan 1984). (CONF-830908—).

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

Experimental results on lower hybrid current drive in tokamak plasmas are reviewed. Pulse lengths of 3.5 seconds and currents above 400 kA have been generated at plasma densities such that the wave frequency is greater than about twice the lower hybrid frequency. Current drive ceases above a critical density, nsub(c). However, nsub(c) increases with wave frequency. So that for f = 4.6 GHz current drive has been seen at n-barsub(e) approx.= 10^{14} cm^{-3} and a density limit has yet to be established. Evidence for a collisional scaling law for current-drive efficiency is summarized. Detailed measurements of bremsstrahlung x-rays show a distribution which is qualitatively similar to that predicted by quasilinear theory. Microwave emission at frequencies less than the plasma frequency may shed light on the current-drive mechanism. Applications of current drive including plasma and current start-up and transformer recharging are discussed.

38963 **Centralized supercomputer support for magnetic fusion energy research.** Fuss, D.; Tull, G.G. (Lawrence Livermore National Laboratory, Livermore, CA). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers);* **72**: No. 1, 32-41(Jan 1984).

High-speed computers with large memories are vital to magnetic fusion energy research. Magnetohydrodynamic (MHD), transport, equilibrium, Vlasov, particle, and Fokker-Planck codes that model plasma behavior play an important role in designing experimental hardware and interpreting the resulting data, as well as in advancing plasma theory itself. The size, architecture, and software of supercomputers to run these codes are often the crucial constraints on the benefits such computational modeling can provide. Hence, vector computers such as the CRAY-1 offer a valuable research resource. To meet the computational needs of the fusion program, the National Magnetic Fusion Energy Computer Center (NMFECC) was established in 1974 at the Lawrence Livermore National Laboratory. Supercomputers at the central computing facility are linked to smaller computer centers at each of the major fusion laboratories by a satellite communication network. In addition to providing large-scale computing, the NMFECC environment stimulates collaboration and the sharing of computer codes and data among the many fusion researchers in a cost-effective manner.

38984 **Saturation of stimulated Brillouin backscatter.** Huey, H.E.; Luhmann, N.C. Jr.; Pawley, C. (Univ. of California Los Angeles, CA 90024). pp 605-619 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract FG01-78MA38058.

This chapter reports on microwave-plasma interaction studies which were conducted in order to investigate Stimulated Brillouin Scattering (SBS). The experimental arrangement for the SBS and optical mixing studies is described. Topics covered include low reflectivity SBS studies; low power optical mixing studies; and SBS with high wall reflectivity. Both the low reflectivity SBS studies and the low power optical mixing experiments indicated that ion tail heating is the dominant saturation mechanism. The tail developed in 1-2 ion periods and had a temperature of Te/2. The results were used to calculate the predicted experimental damping. Presents 11 photos and a diagram.

38985 **High frequency instabilities in underdense plasma produced by a 0.35 μm laser beam.** Figueroa, H.; Azechi, H.; Clayton, C.E.; Ebrahim, N.A.; Estabrook, K.; Joshi, C. (Univ. of California Los Angeles, CA 90024). pp 527-543 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract AC08-80DP40124;AS08-81DP40166;AS08-81DP40167.

This chapter discusses the scattering and absorptive characteristics of the stimulated Raman scattering (SRS) and the two-plasmon decay instabilities in underdense plasmas produced by a 0.35 μm laser beam. At this short wavelength collisional or inverse bremsstrahlung absorption is the dominant coupling mechanism. Topics covered include plasma diagnostics, Raman scattering from foil targets, hot electron characteristics from foil targets, and Raman from low density plastic targets. Stimulated Raman back and sidescattering below the convective Raman threshold is observed. Comparison with simulations indicates that the instability is strongly driven by thermal self-focusing of the 0.35 μm laser beam in a pre-formed plasma. High energy electrons are observed from a plasma with density above n /SUB c/ /4 but below n /SUB c/ . It is demonstrated that when a low density plastic target is used to produce a long plasma, Raman backscatter levels reach up to 10^{-2} J/J/Sr. Includes a table and 2 diagrams.

38986 **Space and time evolution of SBS ion waves and harmonics.** Clayton, C.E.; Chen, F.F.; Joshi, C. (Dept. of Electrical Eng. Univ. of California Los Angeles, CA 90024). pp 621-631 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract AS08-81DP40135;AS08-81DP40163.

This chapter presents the results of a study of the stimulated Brillouin scattering (SBS) ion wave using collective ruby-laser Thomson scattering as the ion wave diagnostic. Topics covered include SBS theory and Thomson scattering theory. It is demonstrated that the Thomson scattered light at 7 1/2° is frequency shifted, obeys the k-matching condition and has a dependence on CO_2 power similar to the Brillouin scattered light. The streaked image of the ion wave shows that the spatial variation of the ion wave is consistent with the prediction from the convective SBS theory. The ion wave is found to contain discrete second and third harmonics. The dependence of the amplitude of the second harmonic on CO_2 laser power as well as its spatial variation imply that harmonic generation is not responsible for the observed saturation of the SBS instability. The observed ion acoustic wave spectrum is consistent with the Fourier spectrum of a steepened wave. Includes 2 diagrams showing experimental arrangements.

38987 **High energy particle acceleration by a laser beatwave.** Sullivan, D.J.; Tajima, T. (Mission Research Corp. Albuquerque, NM). pp 1093-1110 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract FG05-80ET53088.

This chapter examines the features of the Plasma Beatwave Accelerator utilizing results from one-dimensional, relativistic, electromagnetic simulations. The beatwave, consisting of parallel propagation of two laser pulses, is a means of creating large amplitude plasma waves. Topics covered include nonlinear wave-wave processes and simulation with preaccelerated particles. Nonlinear wave-wave processes are responsible for plasma wave growth. It is demonstrated that Raman Backward Scattering saturates quickly in underdense plasma, and wave synchronism is maintained provided particle trapping does not damp the wave and produce a turbulent plasma. Includes a table and a diagram.

38988 **Crystal diffraction systems for X-ray spectroscopy, imaging, and interferometry of laser fusion targets.** Yaakobi, B.; Burek, A.J. (Laboratory for Laser Energetics, Univ. of Rochester, 250 E. River Rd., Rochester, NY 14623). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **19**: No. 12, 1841-1854(Dec 1983).

Recent developments in X-ray diagnosis of laser produced plasmas, involving X-ray diffraction systems, are reviewed. Three

methods currently under development are described: Von Hamos focusing crystal X-ray spectrograph, Laue crystal spectrograph and imaging devices, and X-ray interferometry crystal devices. Some of the results shown are a method of using mosaic crystals in a geometry which yields both high sensitivity and resolution; ionic spectral lines of higher energy (12-14 keV) than has been previously observed; and two-dimensional achromatic Laue imaging of about 10 μm resolution.

38989 **Stochastic electron heating in longitudinal waves.** Schmidt, G.; Wang, B.H. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Physics). *Comments on Plasma Physics and Controlled Fusion;* 8: No. 2, 69-75(Oct 1983).

Numerical experiments are carried out on an electron gas in a standing wave field whose amplitude grows in time. When the amplitude is small, ponderomotive bunching with negligible heating is seen. When the amplitude is sufficiently large to lead to substantial destruction of KAM surfaces, bunching saturates and debunching sets in, accompanied by strong electron heating.

38990 **Plasma eigenmodes and particle acceleration.** Rowland, H.L.; Papadopoulos, K. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy); Tanaka, M. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). *Comments on Plasma Physics and Controlled Fusion;* 8: No. 2, 77-84(Oct 1983).

Recent simulations have revealed that for low initial ion beam velocities ($v_{sub(d)} < 3v_{sub(ti)}$), the modified two stream instability leads to the formation of superthermal electron tails instead of the bulk heating seen for higher initial $v_{sub(d)}$. This tail formation arises from a nonadiabatic change in the normal modes of the plasma due to strong heating of the ions by the instability. In another example a change in the normal modes is shown to lead to ion heating when the low frequency normal modes of a plasma change from nonlinear eigenmodes (i.e., cavitons) to linear ion-acoustic waves.

38991 **Theoretical modeling of electromagnetically imploded plasma liners.** Roderick, N.F.; Kohn, B.J.; McCullough, W.F.; Beason, C.W.; Lupo, J.A.; Letterio, J.D. (Air Force Weapons Lab., Kirtland AFB, NM (USA)); Kloc, D.A. (Air Force Academy, CO (USA)); Hussey, T.W. (Sandia National Labs., Albuquerque, NM (USA)). *Laser and Particle Beams;* 1: 181-206(May 1983).

The generation of high-energy-density plasmas by the electromagnetic implosion of cylindrical foils is explored analytically and through numerical simulation. Theoretical investigations have been performed for a variety of foil initial conditions for both capacitive and inductive pulsed power systems. The development of the theoretical modeling techniques is presented, covering both circuit models and plasma load models. Results from a series of configurations are given, showing the development of modelling techniques used to study the dynamics of the plasma implosion process and the role of instabilities. Interaction between analytic techniques and detailed numerical simulation has led to improvement in all theoretical modeling techniques presently used to study the implosion process. Comparisons of implosion times, shell structure, instability growth rates, and thermalization times have shown good agreement between analytic/heuristic techniques and more detailed two dimensional magnetohydrodynamic simulations. These in turn have provided excellent agreement with experimental results for both capacitor and inductor pulse power systems.

38992 **Computational methods for mirror reactors.** Devoto, R.S. (Lawrence Livermore National Laboratory, Livermore, CA). *Nuclear Technology/Fusion;* 3: No. 2, 304-317(Mar 1983).

Computational methods employed in analyzing plasma aspects of tandem mirror reactors are described. Representative applications to recent reactor designs are given.

38993 **Calculation of energy transport by cyclotron radiation in fusion plasmas.** Tamor, S. (Science Applications Inc., La Jolla, CA). *Nuclear Technology/Fusion;* 3: No. 2, 293-303(Mar 1983).

A computer code has been developed that solves the transport equation for cyclotron radiation in an arbitrary axisymmetric system. The physics underlying the transport is discussed and the method of solution described in some detail. Illustrative results are presented for both energy transport profiles and the spectrum of emitted radiation.

38994 **Application of particle simulation codes to fusion reactor engineering.** Morse, E.; Drobot, A.; Friedman, A.; McNamara, B. (University of California-Berkeley Department of Nuclear Engineering, Berkeley, California). *Nuclear Technology/Fusion;* 3: No. 2, 287-292(Mar 1983).

Particle simulation codes are useful for calculating the dynamics of systems of charged particles in magnetic fields. These codes can integrate ion and electron trajectories in applied or self-consistent electromagnetic fields. The codes have application to several areas of fusion reactor design, including plasma dynamic questions in the reactor plasma as well as in the design of devices for plasma heating. The central themes of plasma simulation, as well as several applications, are described.

38995 **Numerical studies of impurities in fusion plasmas.** Hulse, R.A. (Princeton Plasma Physics Laboratory, Princeton, NJ). *Nuclear Technology/Fusion;* 3: No. 2, 259-272(Mar 1983).

The coupled partial differential equations used to describe the behavior of impurity ions in magnetically confined controlled fusion plasmas require numerical solution for cases of practical interest. Computer codes developed for impurity modeling at the Princeton Plasma Physics Laboratory are used as examples of the types of codes employed for this purpose. These codes solve for the density of ions in each charge state of the impurity and their associated radiation rates using atomic physics appropriate for these low-density high-temperature plasmas. The simpler codes solve local equations in zero spatial dimensions while more complex cases require codes that explicitly include transport of the impurity ions simultaneously with the atomic processes of ionization and recombination. Typical applications are discussed and computational results are presented for selected cases of interest.

38996 **Transport simulation of magnetohydrodynamic effects in Tokamaks.** Houlberg, W.A.; Hogan, J.T. (Oak Ridge National Laboratory, Fusion Energy Division Oak Ridge, Tennessee). *Nuclear Technology/Fusion;* 3: No. 2, 244-258(Mar 1983).

Methods for incorporating magnetohydrodynamic equilibria and internal instabilities into Tokamak transport codes are reviewed with emphasis on how the models may be extended to reactor plasmas. Instabilities are characterized from a computational view as being either intermittent or continuous modes. Intermittent disturbances are treated adiabatically whereas saturated instabilities can be handled through enhanced transport coefficients. The $m = 1/n = 1$ mode serves as an example of how the character of an instability can change as we proceed from low-beta resistive plasmas to high-beta collisionless plasmas. The implications for reactor thermal dynamics of finite-beta-induced transport are discussed in terms of Impurity Studies Experiment-B observations and analysis.

38997 **One-dimensional and 1 1/2-dimensional profile calculations in tokamak plasmas.** Baxter, D.C.; Byrne, N. (Science Applications Inc., La Jolla, CA). *Nuclear Technology/Fusion;* 3: No. 2, 236-243(Mar 1983).

The physics of deuterium-fueled tokamak reactors and a transport code, DDMAK, developed to model them are described. Two examples of work done with this code are presented. In the first, the possible temperature profile broadening effect of synchrotron radiation is examined quantitatively and found small. The second example is a study of the importance of nuclear elastic scattering (NES) in the context of a deuterium-deuterium reactor plasma. Although there are some differences in the DDMAK results due to NES, the overall effect is small. Still the calculational methods may be important for future, more demanding cases.

38998 **Radio-frequency heating and neutral atom transport in a fluid-magnetohydrodynamic treatment of burning tokamak plasmas.** Conn, R.W.; Mau, T.K.; Prinja, A.K. (University of California-Los Angeles School of Engineering and Applied Science Fusion Engineering and Physics Program Los Angeles, California). *Nuclear Technology/Fusion;* 3: No. 2, 217-235(Mar 1983).

A physical model for the space and time evolution of the primary parameters of ordinary and burning tokamak plasmas is described by employing a fluid plasma treatment coupled to a magnetohydrodynamic equilibrium description, the solution to the appropriate Maxwell equations, and the solution of the linear transport equation describing neutral atom transport in plasmas. The specific problems of plasma heating by ion cyclotron radiofrequency (ICRF) waves and neutral atom transport in the plasma edge and in complicated geometrical components such as divertor channels or pumped limiter structures are analyzed. A theoretical, onedimensional slab model of ICRF heating at $\omega = 2\omega$/SUB cD/ is developed and applied to determine the space-time response of tokamak plasmas. Generally, strong single-pass absorption is found for high-density, high (β) plasmas using a low k_{11} spectrum (0.05 to 0.1 cm^{-1}) although for ($\beta > 1\%$, electron Landau damping becomes important. Deterministic and Monte Carlo methods to solve the neutral atom transport problem are described. Specific application to determine the spectrum of neutral atoms emerging from the duct of a pump limiter shows it to be hard (mean energy > 20 eV), indicating very incomplete energy thermalization. Uncertainties are identified in the overall problem of dynamic burning plasma analysis caused by the complexity of the problem itself and by uncertainties in fundamental areas such as plasma transport coefficients, stability, and plasma edge physics.

38999 **Highly ionized atoms in tokamak discharges.** Hinnov, E. (Princeton University Plasma Physics Laboratory Princeton, New Jersey). pp 49-74 of Atomic physics of highly ionized atoms. Vol. B96. Marrus, R. New York, NY; Plenum Publishing Corp. (1983). (CONF-8206219—).

From NATO Advanced Study Institute on the atomic physics of highly ionized atoms; Cargese, France (7 Jun 1982).

The interest of atomic physics has shifted toward heavier elements in tokamak plasmas because of the localized information that they are capable of providing in the hot interior of the plasma. This diagnostic use of appropriate elements in the plasmas is the topic of the present work. As a new generation of larger tokamaks is scheduled to become operational, this discussion considers what plasma spectroscopic diagnostics would be desirable for the study of the inner workings of such unprecedented regimes. The essential features of takamak plamas, the important aspects of atomic physics in relation to such plasmas, and finally a scheme of necessary data base appropriate for spectroscopic diagnostics of tokamak plasmas in the near future are described. Specifically, the physics of highly ionized atoms in the environment of tokamak plasmas, the diagnostic applicability of different elements to particular tokamak discharge conditions, and the status of available atomic physics data concerning the low configuration of ions of elements up to molybdenum are considered.

39000 **Materials and components for X-ray diagnostic use on the Tokamak Fusion Test Reactor.** Moshey, E.A. (Princeton University, Plasma Physics Laboratory Princeton, New Jersey). pp 248-257 of Materials in nuclear energy. Metals Park, OH; American Society for Metals (1982). (CONF-8209200—).

From ASM Canadian Council and Canadian Nuclear Society conference on materials in nuclear energy; Huntsville, Canada (29 Sep 1982).

X-ray diagnostic equipment will operate on Princeton's Tokamak Fusion Test Reactor (TFTR) during Hydrogen (HH and DH), Deuterium (DD) and Tritium (DT) discharges. The environmental requirements on diagnostic equipment with direct conductance to the Tokamak's vacuum are demanding. The materials and components will be subjected to: (a) ultra-high vacuum of 1×10^{-8} torr, (b) temperature cycling from 15°C to 250°C, (c) radiation to 1×10^{8} rads, (d) magnetic fields to 6 Tesla. In addition, selection of materials must also be based upon minimizing the formation of significant quantities of long lived radioactive elements created by the bombardment of 14 MeV neutrons. Shielding materials must also meet flammability requirements. This paper deals with the selection of materials and components as used on the TFTR X-ray Imaging Systems and the TFTR Pulse-Height Analysis Systems. The tradeoffs that led to selection of materials are discussed. Test results and sources of test data are presented.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 70020037256, 37256, 38129, 38153, 38976, 38981

39001 **(ANL/FPP/TM—187) Design and analysis of a low edge temperature divertor for INTOR.** Brooks, J.N.; Mattas, R.F.; Hassanein, A.M.; Baskes, M.I. (Argonne National Lab., IL (USA); Sandia National Labs., Livermore, CA (USA)). May 1984. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015448.

A low plasma edge temperature regime has been proposed for the INTOR divertor in order to minimize erosion on the collector plate. We have examined the design and lifetime issues of a divertor plate operating in such a regime. These issues include the choice of materials, erosion due to sputtering and disruptions, thermal response, and tritium permeation. We have concluded that a tungsten coated, copper substrate plate offers the possibility of low erosion coupled with good thermal properties. However, there are many unresolved issues with this and other plate configurations. These issues include the transfer of first wall sputtered material to the plate, tritium permeation into the coolant, materials problems such as radiation swelling, embrittlement, and joining.

39002 **(CAPE—2941) Display model of MFTF vapor cooled power lead at Fermilab exhibition (Engineering Materials).** (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1983. Contract W-7405-ENG-48. TIC, PO Bx 62, Oak Ridge, TN 37831. Order Number TI84013643.

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This is a helium cooled power lead for the MFTF-B superconducting magnets.

39003 **(CONF-840614—85) All-remote configuration for the ETR-INTOR tokamak design.** Spampinato, P.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014293.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

The objective of this study is to develop a comparison of the costs and engineering implications of improving tritium containment and shielding as required for personnel access (FED-INTOR) versus adopting a totally remotely operated and maintained design (ETR-INTOR). The work presently underway has focused on developing a device configuration which is amenable to all-remote operations, reducing the biological shielding on the plasma chamber, assessing tritium containment requirements for both designs, and developing facility layouts for both designs.

39004 **(CONF-8404173—) Workshop on high heat flux materials for TFCX.** (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 365p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84014813.

From Workshop on high heat flux materials for TFCX; Germantown, MD, USA (17 Apr 1984).

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The workshop reviewed the performance requirements for high-heat-flux material in TFCX, summarized existing materials and materials technologies for meeting these requirements, identified critical near-term materials R and D for high-heat flux components, and reviewed the status of materials test facilities for performing the necessary R and D.

39005 **(DOE/ER/52076—8) EPFL (Swiss) fusion-fission hybrid experiment. Progress report No. 7, May 1, 1983-July 31, 1983.** Woodruff, G.L.; Sitaraman, S. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 1 Oct 1983. Contract AT06-82ER52076. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013794.

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The principal effort during the three month period May 1, 1983 to July 31, 1983 consisted of setting up a surface source model for the Haefely neutron tube. The main reason for this, as has been pointed out in previous reports, was the complexity of the Haefely neutron tube. The main thrust of the recent work has been towards testing the feasibility of using this patch in generating a source on the surfaces of the Haefely tube. In addition, a few corrections have been made to the results for the 1D and 2D simulation of the Lotus Hybrid blanket-I assembly, presented in the previous report.

39006 **(DOE/ER/52076—9) EPFL (Swiss) fusion-fission hybrid experiment. Progress report No. 8, August 1, 1983-October 31, 1983.** Woodruff, G.L. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 1 Dec 1983. Contract AT06-82ER52076. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013795.

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The configuration of the References ThO_2/Li_2CO_3 Blanket Assembly is shown. One of the difficulties in the use of the Haefely Neutron source is the inability to modulate the source intensity. In order to circumvent this difficulty, a second, used tube has been obtained. This is a tube which has reached the end of its effective lifetime and, therefore, has a reduced output. It can be operated at its initial reduced intensity and then be subsequently further reduced in output as needed. A method for producing blocks of Li_2CO_3 has been developed, tested, and implemented. Some measurements of the spatial, energy, and angular distribution from the Haefely Neutron source are described.

39007 **(DOE/ER/52076—10) EPFL (Swiss) fusion-fission hybrid experiment. Progress report No. 9, November 1, 1983-March 1, 1984.** Woodruff, G.L.; Sitaraman, S. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 15 Mar 1984. Contract AT06-82ER52076. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013755.

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The Monte Carlo work done during this period focused on studying the effect of a 316-stainless steel ring which has been proposed to fit around the Haefely tube. The motivation for adding such a ring is to reflect more neutrons in the forward direction and hence minimize room return. Additional benefits which might be expected include an increase in the current of neutrons crossing the first wall, and a somewhat softer source spectrum. The latter is a desirable change since in an actual fusion reactor the spectrum of neutrons crossing the first wall consists of lower energy scattered neutrons in addition to the 14 MeV neutrons from the D-T reactions.

39008 **(DOE/ET/52053—T1) Report on studies for CW megawatt gyrotrons.** Read, M.E.; Fliflet, A.; Kim, K.J.; Chu, K.R.; Manheimer, W. (Naval Research Lab., Washington, DC (USA)). 15 Dec 1983. Contract AI01-79ET52053. 83p. NTIS, PC A05; 3; GPO Dep. Order Number DE84007332.

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The experiments performed with the complex cavity gyrotron have demonstrated that the concept can be used to suppress mode competition in high order mode cavities. Further, the design of a complex cavity gyrotron with an output power of 1 MW at 100 GHz and which is compatible with CW operation appears quite feasible. Clearly, many details of the design, as well as technical issues not addressed here, must be clarified. And, further experimentation will be required before a CW device can be efficiently developed.

39009 **(DOE/NBM—4014686) Fusion and its future in Illinois.** Baker, C.C. (comp.). (Illinois Governor's Commission on Science and Technology, Springfield (USA). Illinois Fusion Power Task Force). Aug 1984. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014686.

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This report was prepared by the Illinois Fusion Power Task Force under the sponsorship of the Governor's Commission on Sciences and Technology. The report presents the findings and recommendations of the Task Force, an explanation of the basic concepts of fusion, a summary of national and international programs and a description of ongoing fusion activities in Illinois.

39010 **(EGG—2309) Fusion Safety Program annual report, fiscal year 1983.** Crocker, J.G.; Holland, D.F. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1984. Contract AC07-76ID01570. 82p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84015231.

The Fusion Safety Program major activities for Fiscal Year 1983 are summarized in this report. The program was initiated in FY 1979, with the Idaho National Engineering Laboratory (INEL) designated lead laboratory, and EG & G Idaho, inc., named as prime contractor to implement this role. The report contains four sections: EG & G Idaho, Inc., activities at the INEL includes progress reports and portions of papers on the tritium implantation experiment, tritium control systems, tritium release from solid breeding blankets, plasma disruptions, risk assessment, transient code development, data base development, and a discussion of participation in the blanket comparison and selection study. The section outside contracts includes progress reports and portions of papers on lithium-lead reactions by Hanford Engineering Development Laboratory (HEDL) and the University of Wisconsin, magnet safety by the Francis Bitter Magnet Laboratory of the Massachusetts Institute of Technology (MIT) and Argonne National Laboratory (ANL), risk assessment by the University of California at Los Angeles (UCLA) and MIT, tritium retention by the University of Virginia, and effects of plasma disruptions by MIT. A list of publications and planned fiscal year 1984 activities are also included.

39011 **(EGG-FSP—6667) Preliminary calculations for testing of Li_2O, $LiAlO_2$, and V/Cr/Ti fusion blanket in an ETR configuration.** Struttmann, D.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1984. Contract AC07-76ID01570. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015170.

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This study utilizes the Engineering Test Reactor (ETR) located at the Idaho National Engineering Laboratory (INEL) as modeled in a previous analysis. Variations in fuel dimensions were studied to indicate the feasibility of utilizing reactors similar to the ETR but of different dimensions. The usefulness of cadmium shielding to harden the neutron spectrum seen by the blanket was also investigated. Descriptions of the models and the calculational methods used are presented. Estimates of the heating rate profiles, neutron spectra, and tritium breeding rates were calculated for each case and are reported.

39012 **(GA-A—17199) Thermal contact conductance measurements on Doublet III armor tile graphite.** Doll, D.W.; Reis, E. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—167). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013554.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Several tests were performed on the Doublet III wall armor tiles to determine the cool-down rate and to evaluate improvements made by changing the conditions at the interface between the graphite tile and the stainless steel backing plate. Thermal diffusivity tests were performed in vacuum on both TiC coated and bare graphite tiles with and without 0.13 mm (.005") thick silver foil at the interface. The results of the armor tile cool-down tests showed improvement when a 0.13 mm (0.005") silver foil is used at the interface. At 2.1 x 10^5 Pa (30 psi) contact pressure, the e-folding

cool-down times for a TiC coated tile, bare graphite and bare graphite with a 0.06 mm (0.0035") silver shim were 10 min., 5.0 min., and 4.1 min., respectively. Tests using high contact pressures showed that the cool-down rates converged to ~ 4.0 min. At this limit, the conduction path along the backing plate to the two cooling tubes controls the heat flow, and no further improvement could be expected. Thermal diffusivity measurements confirmed the results of the cool-down test showing that by introducing a silver foil at the interface, the contact conductance between Poco AXF-5Q graphite and 316 stainless steel could be improved by a factor of three to eight. The tests showed an increasing improvement over a range of temperatures from 25°C to 400°C. The data provides a technical basis for further applications of graphite tiles to cooled backing plates.

39013 **(GA-A—17203) Material failures observed in Doublet III neutral beamlines.** Bailey, E.W.; Colleraine, A.; Doll, D.; Grunloh, H.; Kim, J.; Langhorn, A.; Thurgood, B. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—164). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013557.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The Doublet III neutral beam injectors consist of three separable spools two meters in diameter by four meters long overall when assembled. Contained within these spools are the neutralizers, ion dumps, deflecting magnet, calorimeter dumps, cryogenic panels and beam scraping collimators 3,7. To date three beamlines are in operation on Doublet III, and the beams have accumulated operating time of approximately 32 months, with the oldest having been in operation for 18 months. During this time operation of DIII with the neutral beam sources has demonstrated the following: 7.8 MW injected neutrals from three beamlines (6 sources), high β (4.5%), and non-circular plasma shape. The sources have also exhibited a very reliable injected shot history 4, 5, 6, 8. Material failures encountered during the operation of DIII N.B. injectors and the solutions to these failures are described. Failures include cracking of the neutralizer exit collimator due to heating cycles, failure of cyropanel support rods due to cooling cycles, failure of the sliding drive of the moveable calorimeter due to friction.

39014 **(GA-A—17204) Doublet III limiter/armor update.** Johnson, E.; McKelvey, T.; Morril, W.; Phelps, R.; Stambaugh, R. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—166). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013555.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The Doublet III device is operating with an extensive system of plasma limiters and wall protective armor. Operations with up to 8MW of neutral beam power and 1.5MA plasma current are planned. Design and operational performance of the following systems are discussed: 1. Water-cooled graphite moveable limiter. 2. Water-cooled graphite fixed limiter and neutral beam wall armor. 3. Radiatively cooled Inconel divertor plates.

39015 **(GA-A—17205) Neutral beam injectors for the Big Dee vessel.** Doll, D.W.; Bailey, E.; Colleraine, A.; Fasolo, J.; Hager, R.; Peuron, A.; Rawls, J.; Sanchez, H. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 7p. (CONF-831203—168). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013654.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The four neutral beam injectors built for Doublet III will be modified to reoptimize beam transmission into the Big Dee vessel. All beamline components will be remounted 90° to their original position in the cylindrical vacuum vessel. This will permit optimum alignment with the available port opening. While these modifications are being incorporated into the disassembled injectors, it is planned that improvements and upgrading features will be added at the least possible cost. The calorimeter will be replaced by two independently driven calorimeters, thus decoupling the operation of the two ion sources. The beam path is being opened up to accommodate a long pulse (cw) source and all beam absorbing surfaces are being increased in size to withstand up to 5 s of operation with heat fluxes up to 700 W/cm². By opening up the apertures along the beam trajectory, an increase in power transmission into the plasma of 33% is realized compared with the present Doublet III performance.

39016 **(GA-A—17225) Field installed brazed thermocouple feedthroughs for high vacuum experiments.** Anderson, P.M.; Messick, C. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—165). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013556.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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In order to reduce the occurrence of vacuum leaks and to increase the availability of the DIII vacuum vessel for experimental operation, effort was applied to developing a vacuum-tight brazed feedthrough system for sheathed thermocouples, stainless steel sheathed conductor cables and tubes for cooling fluids. This brazed technique is a replacement for elastomer O ring sealed feedthroughs that have proven vulnerable to leaks caused by thermal cycling, etc. To date, about 200 feedthroughs have been used. Up to 91 were grouped on a single conflat flange mounted in a bulkhead connector configuration which facilitates installation and removal. Investigation was required to select a suitable braze alloy, flux and installation procedure. Braze alloy selection was challenging since the alloy was required to have: (1) Melting temperature in excess of the 250°C (482°F) bakeout temperature. (2) No high vapor pressure elements. (3) Good wetting properties when used in air with acceptable flux. (4) Good wettability to 300 series stainless steel and Inconel.

39017 **(GA-A—17557) Means of varying conditions in the expanded boundary divertor without affecting energy confinement.** Burrell, K.H.; Ohyabu, N.; Chase, R.; Kahn, C.; Petrie, T. (GA Technologies, Inc., San Diego, CA (USA)). May 1984. Contract AT03-84ER51044. 21p. (CONF-840520—13). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013840.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Expanded boundary divertor discharges in Doublet III have shown a significant enhancement in confinement relative to limiter discharges with similar plasma density, current, toroidal field and neutral beam heating power. This improvement is insensitive to divertor density, recycling rate and power radiated from the divertor. Accordingly, it may be possible to exploit the improved divertor confinement in a fusion reactor while independently adjusting conditions in the divertor to satisfy reactor engineering constraints.

39018 **(GA-A—17585) Effect of a single blade limiter on energetic neutral beam particles in Doublet III.** Petrie, T.W.; Armentrout, C.; Burrell, K.H.; Hino, T.; Kahn, C.; Kim, J.; Lohr, J.; Rottler, L.; Schissel, D.; St. John, H. (GA Technologies, Inc., San Diego, CA (USA)). May 1984. Contract AT03-84ER51044. 21p. (CONF-840520—11). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013842.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Energetic beam ion collisions with the main limiter can be a significant power loss process under certain operating conditions in Doublet III. Furthermore, these collisions may cause measurable damage to the limiter itself. Under low current and low toroidal field conditions (e.g., I/sub p/ = 290 kA and B/sub T/ = 6.3 kG), 20 to 38% of the inferred absorbed beam power may be deposited directly on the ion drift side of the limiter by the beam ions. However, for higher plasma current and toroidal fields (e.g., I/sub p/ = 480 kA and B/sub t/ = 15 kG), the fraction of inferred absorbed beam power deposited on the limiter is reduced to <10%. Monte Carlo code simulations show that this loss of beam power is primarily a result of the large poloidal and toroidal gyro-orbits of the en-

ergetic beam ions. Other factors which may enhance beam ion losses to the limiter are (1) large separation distances between the primary limiter and the (outboard) vacuum vessel wall, and (2) plasma density buildup near the plasma edge during high gas puff operation.

39019 **(LA-UR—84-1938) Design, construction, and operational results of an 800-A, 10-kV hot deck amplifier.** Reass, W.A. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 9p. (CONF-8406137—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014044.

From 16. power modulator symposium; Arlington, VA, USA (17 Jun 1984).

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This paper describes the electrical design, implementation, and operational results of a high fidelity (feedback regulated) 800 A, 10-kV hard tube, hot deck amplifier. The amplifier can produce any linear waveform to 800-A for 30 ms and beyond (depending on main energy storage). The present use is to drive the vertical field (VF) control windings on ZT-40M, a toroidal reversed field pinch plasma physics experiment. Although our application requires only 10 kV (8 MW) of switching, anode voltage may be as high as 40 kV (32 MW).

39020 **(LA-UR—84-1939) Development of the Antares electron gun.** Stine, R,; Leland, W.; Mansfield, C.; Rosocha, L.; Jansen, J.; Gibson, R.; Allen, G. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840981—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014043.

From 11. international symposium on discharges and electrical insulation in vacuum; Berlin, F.R. Germany (24 Sep 1984).

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Antares is the Los Alamos National Laboratory 40-kJ, 1-ns, CO_2 laser system that is now operational. This laser system was developed for the Intertial Confinement Fusion (ICF) program and is beginning target experiments. The distributed circuit modeling, design and operation of the large electron gun developed for the final laser power amplifier are reviewed. This gun is significant because of the large electron current area, 9 m^2; the number of emitter blades, 48; the dual cathode current return; and the coaxial geometry and grid control. The gun components and their development are discussed. These include the emitter blades, the coaxial grid (to maintain constant electron current during the 5-μs pulse), the bonded stacked-ring insulator (to electrically insulate the grid/cathode), the Kapton/aluminum electron transmission windows (to provide an interface between gun vacuum and laser gas) and the vacuum shell (operated at a vacuum of 10^{-6} torr). A unique pressure diagnostic is also discussed.

39021 **(LA-UR—84-2023) Physics of reversed-field pinch profile sustainment.** Moses, R.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 22p. (CONF-840616—19). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014024.

From International conference on plasma physics; Lausanne, Switzerland (27 Jun 1984).

A description of the Reversed-Field Pinch (RFP) is given, emphasizing the necessity of a magnetohydrodynamic (MHD) or kinetic process to sustain field reversal. Three sustainment mechanisms are reviewed: the MHD dynamo, the tangled discharge model, and nonlocal resistivity. A slab model of steady (ohmic) states is described. A relationship between ohmic state wave numbers and the minimum amplitude of nonsymmetric field components is given. If ohmic states are the sole source of the sustainment process, their wave lengths are probably much longer than the minor diameter of the plasma. Otherwise field asymmetries would exceed those observed in experiments. It is noted that internal field data are still limited, restricting the generality of our comments.

39022 **(LBL—17657) Heavy ion fusion half-year report, October 1, 1983-March 31, 1984.** (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013885.

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Results from the Single Beam Transport Experiment (SBTE) showed that stable beam transport in a 41-period AG lattice with single-particle phase advance per period, $\sigma_0 + 60°$, was possible with space-charge forces large enough to depress the phase-advance to $\sigma = 12°$. We have since extended that result and have shown that depression from $\sigma_0 = 60°$ to $\sigma = 8°$ is still stable. Measurements of the Cs^+ ion beam attenuation in the SBTE at different gas pressures, taken together with the different lattice acceptances for singly and doubly-charged ions, have allowed us to measure both the electron pick-up and electron cross-sections for Cs^+ on nitrogen at 160 keV. A large effort is under way to arrive at a conceptual reference design for the Multiple Beam Experiment (MBE), so that final engineering design and prototyping can begin as soon as possible. The MBE design process has stimulated many detailed questions for the theory group and several important results have ensued. For instance, on the question of what magnitude of sextupole component could be tolerated in the lenses, computer simulation showed that, for a space-charge-dominated beam, a significant sextupole term had essentially no effect if the beam remained on axis, but led to intolerable emittance growth for the practical case of an off-axis beam.

39023 **(LBL—17788) Induction linacs for heavy ion fusion research.** Fessenden, T.J. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 7p. (CONF-840529—39). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013395.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

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The new features of employing an induction linac as a driver for inertial fusion involve (1) transport of high-current low-emittance heavy ion beams, (2) multiple independently-focused beams threading the same accelerator structure, and (3) synthesis of voltage waveforms to accomplish beam current amplification. A research program is underway at LBL to develop accelerators that test all these features with the final goal of producing an ion beam capable of heating matter to $\sim$ 70 eV. This paper presents a discussion of some properties of induction linacs and how they may be used for HIF research. Physics designs of the High Temperature Experiment (HTE) and the Multiple Beam Experiment (MBE) accelerators are presented along with initial concepts of the MBE induction units.

39024 **(N—8329049) Comparison of lower hybrid ion heating in Tokamak and stellarator plasmas in JIPP T-2.** Ohkubo, K.; Kawahata, K.; Kawasumi, Y.; Matsuoka, K.; Noda, N.; Sakurai, K.; Tanahashi, S.; Matsuura, K.; Fujita, J. (Nagoya Univ. (Japan)). Apr 1983. 41p. (IPPJ—629). NTIS, PC A03/MF A01.

Experimental studies of lower hybrid ion heating in the Tokamak and stellarator plasmas were carried out in the JIPP T-2 torus. In both operations of the Tokamak and the stallarator, ion heating efficiency of bar n (e) delta T (i)/p (net) 1.2 x 10 to the 13th power eV x 1/kW/cu cm is observed at a power level of 160 kW to 180 kW. The ion absorption efficiency of RF power in the stallarator is two thirds as large as that in the Tokamak. It is confirmed that the perpendicular energetic ion tails are produced near the plasma center and suffered from the pitch angle scattering to the parallel direction, and at the same time, energetic ions escape out of the plasma due to delta B drift.

39025 **(N—8330236) Fusion Energy Workshop.** (Committee on Science and Technology (U.S. Congress. House), Washington, DC). 1982. 161p. (PUBL—97-128; GPO—12-821). Subcommittee on Energy Research and Production, 97th Congress, Washington, DC.

Joint hearing before the Subcomm. on Energy Res. and Production of the Comm. on Sci. and Technol. and the Subcomm. on Energy Res. and Develop. of the Comm. on Energy and Nat. Resources, 97th Congr., 2nd Sess., No. 176, 8 Sep 1982.

Technology and public policy related to magnetic fusion research and development in the United States are discussed. Physics issues which must be addressed are identified and examined. Inter-

national cooperation and the types of reactors being developed in other countries are considered as well as program characteristics, risk levels, and management approaches in the United States.

39026 **(NBSIR—84-3000) Materials studies for magnetic fusion energy applications at low temperatures. VII.** Reed, R.P.; Simon, N.J. (eds.). (National Bureau of Standards, Boulder, CO (USA). Fracture and Deformation Div.). May 1984. 415p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE84013487.

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Separate abstracts were prepared for 21 of the included sections. (MOW)

39027 **(PPPL—2119) Kinetic equation for spin-polarized plasmas.** Cowley, S.C.; Kulsrud, R.M.; Valeo, E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1984. Contract AC02-76CH03073. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015154.

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The usual kinetic description of a plasma is extended to include variables to describe the spin. The distribution function, over phase-space and the new spin variables, provides a sufficient description of a spin-polarized plasma. The evolution equation for the distribution function is given. The equations derived are used to calculate depolarization due to four processes, inhomogeneous fields, collisions, collisions in inhomogeneous fields, and waves. It is found that depolarization by field inhomogeneity on scales large compared with the gyroradius is totally negligible. The same is true for collisional depolarization. Collisions in inhomogeneous fields yield a depolarization rate of order $10^{-4}S^{-1}$ for deuterons and a negligible rate for tritons in a typical fusion reactor design. This is still sufficiently small on reactor time scales. However, small amplitude magnetic fluctuations (of order one gauss) resonant with the spin precession frequency can lead to significant depolarization (depolarises triton in ten seconds and deuteron in a hundred seconds.)

39028 **(SAND—84-1135C) Tritium inventory and permeation in TFTR.** Baskes, M.I.; Brice, D.K.; Heifetz, D.B.; Dylla, H.F.; Wilson, K.L.; Doyle, B.L.; Wampler, W.R.; Cecchi, J.L. (Sandia National Labs., Livermore, CA (USA); Sandia National Labs., Albuquerque, NM (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). 1984. Contract AC04-76DP00789. 27p. (CONF-840520—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84013802.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

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The control of tritium in TFTR has both important safety and environmental implications. Current modelling techniques allow realistic predictions of the tritium inventory in and permeation through in-torus components. The source of the tritium was computed using a three-dimensional description of the neutral particle flux on the TFTR vacuum vessel wall from the neutral transport code DEGAS, under plasma conditions modelled with the one-dimensional transport code BALDUR. The movable limiter (graphite) was modelled using an extension of the Local Mixing Model for hydrogen retention and isotope exchange. In particular, the calculations consider the inventory and recyling for the movable limiters (which are expected to experience transient temperatures up to 2000°C) as well as the bumper limiters and protective plates which will remain somewhat cooler. Transient effects are included. The tritium transport in the stainless steel wall was modelled using the DIFFUSE code with materials parameters taken from the most recent literature. It appears that for the expected material properties, specifically the hydrogen recombination constant measured in a clean TFTR environment, and operating scenario, there will be essentially no tritium permeation through the stainless steel walls or bellows and less than 0.1 kCi of tritium inventory in the stainless steel first wall. The limiters contain as much as 5 kCi of tritium.

39029 **(UCID—20102) Dynamic testing of NOVA laser switchyard tower.** Weaver, H.J.; Pastrnak, J.W.; Fields, D.E. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1984. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014450.

NOVA is the latest in a series of powerful laser systems designed to study the feasibility of initiating a controlled fusion reaction by concentrating several laser beams on a small fuel target. The laser components, turning mirrors and target chamber are all mounted on large steel frame structures. These structures were first analyzed via finite element models to access their seismic integrity as well as their overall vibrational stability. When construction was completed, a modal analysis was performed on the structures to verify and improve the finite element models. This report discusses the linking of the analytical and experimental studies for the NOVA switchyard tower structure.

39030 **(UCID—20121) Displacement damage in the first structural wall of an inertial confinement fusion reactor: dependence on blanket design.** Meier, W.R. (Lawrence Livermore National Lab., CA (USA)). 13 Jul 1984. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015082.

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In this study we investigate how the design of the neutron blanket effects the displacement damage rate in the first structural wall (FSW) of an Inertial Confinement Fusion (ICF) reactor. Two generic configurations are examined; in the first, the steel wall is directly exposed to the fusion neutrons, whereas in the second, the steel wall is protected by inner blanket of lithium with an effective thickness of 1-m. The latter represents a HYLIFE-type design, which has been shown to have displacement damage rates an order of magnitude lower than unprotected wall designs. The two basic configurations were varied to show how the dpa rate changes as the result of (1) adding a Li blanket outside the FSW, (2) adding a neutron reflector (graphite) outside the FSW, and (3) changing the position of the inner lithium blanket relative to the FSW. The effects of neutron moderation in the compressed DT-target are also shown, and the unprotected and protected configurations compared.

39031 **(UCLA/PPG—728) Report of the DOE panel on low activation materials for fusion applications.** Conn, R.W. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). Jun 1983. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014341.

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In February, 1982, the Office of Fusion Energy, DOE, through its Division of Development and Technology, established a Panel to examine materials with attractive radioactivation characteristics for applications in fusion power reactors. Since February, the Panel has met together and in subgroups numerous times. Input from knowledgeable people was elicited via a two day workshop held at UCLA in April, 1982. The agenda, titles of talks, and speakers are given in Appendix II. We present here a synopsis of the Panel's findings based upon both external information provided to us and upon the work and deliberations of the Panel itself. Conclusions and recommendations follow. Background technical information brought together by the Panel is relegated to Appendices III and IV.

39032 **(UCRL—88295) Experience with a high order programming language on the development of the Nova distributed control system.** Suski, G.J.; Holloway, F.W.; Duffy, J.M. (Lawrence Livermore National Lab., CA (USA)). 10 May 1983. Contract W-7405-ENG-48. 23p. (CONF-8305210—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014701.

From 5. IFAC workshop on distributed computer control systems; Transvaal, Africa (18 May 1983).

This paper explores the impact of an HOL on the development of the distributed computer control system for Nova laser fusion facility. As the world's most powerful glass laser, Nova will generate 150 trillion watt pulses of infrared light focused onto

fusion targets a few millimeters in diameter. It will perform experiments designed to explore the feasibility of fusion as an energy source of the future. Nova will utilize fifty microcomputers and four VAX-11/780's in a distributed process control computer system architecture.

39033 **(UCRL—90137) 850 J, 150 ns narrow-band krypton fluoride laser.** Goldhar, J.; Jancaitis, K.S.; Murray, J.R.; Schlitt, L.G. (Lawrence Livermore National Lab., CA (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). 16 Dec 1983. Contract W-7405-ENG-48. 7p. (CONF-840629—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84013077.

From 13. international quantum electronics conference; Anaheim, CA, USA (18 Jun 1984).

We report laser experiments on a 248 nm KrF laser with a 30x40x120 cm gain volume and an injection locked unstable resonator cavity. The volume is pumped by six 450 kV, 90 kA electron beam generators using water pulse forming lines.

39034 **(UCRL—90825) Upgrade of MFTF-B for fusion technology.** Thomassen, K.I.; Doggett, J.N.; Logan, B.G.; Nelson, W.D. (Lawrence Livermore National Lab., CA (USA); Oak Ridge National Lab., TN (USA)). 24 May 1984. Contract W-7405-ENG-48. 46p. (CONF-8405206—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84014702.

From Meeting on fusion technology test facility; Karlsruhe, F.R. Germany (29 May 1984).

This report discussses such things as operating scenarios and engineering features of the upgrade. In particular, such things as the magnet system, heating, fueling, drift pumping, halo scraper, direct converter, vacuum pumping, tritium systems, vacuum vessel and support structure, shielding, electrical systems, maintenance, safety and siting, and the operation and test program are described. (MOW)

39035 **Series-field-coil ion beam diode experiment and numerical simulation.** Mendel, C.W. Jr.; Quintenz, J.P.; Zagar, D.M.; Johnson, P.R.; Anderson, R.J.; Widner, M.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **56**: No. 3, 637-647(1 Aug 1984). Contract AC04-76DP00789.

An experiment with a series-field-coil intense ion beam diode operating at the 1.6-MV, 0.8-TW level is described. The diode operates in the extraction mode with a 20-cm focal length. The diode design procedure is described together with some of the essential ion diode theory used in this design process. The experiment produced a well-focused ion beam while verifying some of the theoretical assumptions about ion diodes of this type. The experimental results are compared with numerical computer simulations and excellent agreement is obtained.

39036 **H^- production on poly- and monocrystalline converters in a surface-plasma ion source.** van Bommel, P.J.M.; Leung, K.N.; Ehlers, K.W. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **56**: No. 3, 751-756(1 Aug 1984).

Monocrystalline (110) and polycrystalline tungsten and molybdenum converter surfaces have been tested in a surface negative hydrogen-ion source, both with and without cesium added to the plasma. With cesium added to the discharge, no significant difference in H^- yield is measured between the four converter surfaces. Energy spectra reveal that the contribution to the total H^- yield from the backscattered hydrogen is negligible compared to the ion-impact desorbed H^- ions. The converter voltage required for optimum H^- production increases with the amount of cesium added to the plasma. The measurements without cesium show roughly equal fractions of backscattered and desorbed H^- ions in the self-extracted beam. The presence of oxygen on the surfaces enhances the ion-impact desorbed (sputtered) H^- yield with respect to the reflected H^- yield. This is attributed to the formation of OH on the surfaces.

39037 **A URA coded aperture camera for the inertial confinement fusion experiments.** Yamanaka, C.; Niki, H.; Yamada, A.; Yamamoto, Y.; Yamanaka, M.; Yamanaka, T. (Inst. of Laser Engineering, Osaka Univ., 2-6, Yamada-Oka, Suita, Osaka 565). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **31**: No. 1, 490-494(Feb 1984). (CONF-831015—).

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A coded aperture camera using m-sequence URA (uniformly redundant arrays) pattern has been constructed for the inertial confinement fusion (ICF) images. The URA camera is much brighter than a single pinhole camera, and then has high S/N. This URA camera has been successfully applied for the first time to take an X-ray image on a cannonball target. The tomographic capability of URA camera is improved by applying an iterative method.

39038 **Novette, a short wavelength laser-target interaction system.** Manes, K.R.; Barr, O.; Gritton, D.; Hildum, S.; Johnson, B.; Kuizenga, D.; Patton, H.; Speck, D.R.; Suski, G.J.; Thompson, C. (Lawrence Livermore National Lab. P.O. Box 5508 Livermore, CA 94550). pp 1-19 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract W-7405-ENG-48.

This chapter reviews propagation studies performed with the Novette laser system at the Lawrence Livermore National Laboratory (LLNL). The characteristics of the incident laser radiation in the target chamber center are described and implications for the Nova laser design are discussed. Nova's design is based on earlier LLNL lasers such as Shiva and its architecture has been influenced by advances in laser/plasma coupling. The Novette Laser Fusion system provides a high power target experimental capability at the second harmonic of Nd:glass. The system will test the Nova laser performance and operability, and will provide the first test of harmonic generation in large aperture multi-element arrays of KDP. Novette will also allow early tests of Nova target physics, third harmonic generation and focusing systems. Includes 9 illustrations and 3 tables.

39039 **Resonantly-pumped soft X-ray lasers using ICF drivers.** Hagelstein, P.L. (Special Studies "O" Group Lawrence Livermore Nat. Lab. P.O. Box 808, L-278 Livermore, CA 94550). pp 99-106 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract W-7405-ENG-48.

This chapter examines some aspects of laser design relating to experiments planned for the Novette laser system at the Lawrence Livermore National Laboratory (LLNL). The purpose of the experiments is to test several resonantly-pumped lasers with transition energies between 42.3 eV and 153 eV. An attempt is made to discuss the major physics design issues and numerical simulations. The target consists of low density gas surrounded by flashlamp and filter systems which produce x-rays upon irradiation, and the idea is to transiently strip the lasing element (neon, fluorine) down to the helium-like or hydrogen-like sequence, and then resonantly pump a 1-3 or 1-4 transition with line radiation produced in the flashlamp. Issues covered include spectroscopy, brightness, the timing of transient ionization, hydrodynamic collapse, and the shock heating of the laser gas. Presents a table and a drawing.

39040 **High intensity free electron lasers for inertial confinement fusion.** Prosnitz, D. (Lawrence Livermore National Lab. P.O. Box 808/L-436 Livermore, CA 94550). pp 193-200 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract W-7405-ENG-48.

This chapter examines the feasibility of using a Free Electron Laser (FEL) as an Inertial Confinement Fusion (ICF) laser driver, giving cost and efficiency estimates for a 3 MJ, 250 nm system. The FEL directly converts the kinetic energy of a relativistic electron beam to laser radiation and therefore has the potential to become a very efficient ICF driver. The FEL utilizes electron accelerator technology and therefore operates with minimum main-

tenance and down time. The discussion is restricted to master-oscillator, power-amplifier laser configurations. The estimates of FEL extraction (38%) are based on one-dimensional models. Presents 4 tables.

39041 **ICF diagnostics.** Coleman, L.W. (Lawrence Livermore National Lab. P.O. Box 5508 Livermore, CA 94550). pp 253-262 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract W-7405-ENG-48.

This chapter discusses results obtained at several laboratories conducting research on laser driven Inertial Confinement Fusion (ICF) target implosions. Low temperature and high density resulting from compressed fuel density produces a situation that is difficult to diagnose. It is predicted that future drivers in the 100 kJ, 100 Tw range will be able to generate sufficient fuel temperature together with high density so that sufficient neutrons will be generated to allow high quality compression diagnosis with neutron diagnostics, including the activation schemes and neutron imaging. Topics covered include the detection of knock-on deuterons and tritons from the interaction of neutrons with those particles in DT fuel; high resolution imaging of characteristic x-ray emission from seed materials; the use of an auxiliary x-ray source (usually a laser produced plasma) to blacklight or probe through a target; grazing incidence x-ray microscopes; neutron activation or radio-chemistry measurements; and imaging the neutron emission from the reacting DT in the compressed target core. Presents a table and 3 drawings.

39042 **Fusion product energy loss measurements.** Miley, G.H.; Bennish, A.H.; Choi, C.K.; Harris, D.B.; Welch, D.R. (Fusion Studies Lab. Univ. of Illinois Urbana, IL 61801). pp 263-282 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract AC08-80DP40124.

This chapter reports on the simultaneous measurement of the mean energy downshift of D-T alphas and D-D protons for a large variety of target wall thicknesses. Topics covered include measuring dE/dx in Inertial Confinement Fusion (ICF) plasmas; slowing down theories; components of the measured energy spectrum; a uniform tamper model; independent tamper temperature measurement; and a comparison of measured data, LILAC, and LILAC-A. The experiment was performed using a Time-of-Flight spectrometer on the University of Rochester's Omega laser system. The goals of the experiment are to compare the measured downshift with those predicted by current theories, and to further develop proton energy-spectra measurements as a diagnostic for the target conditions during ablative pusher experiments. The tamper density-radius product, the compressed tamper electron temperature, and the fuel ion temperature are emphasized. It is demonstrated that the data obtained as a function of shell thickness has already provided a means of improving the hydrodynamics code LILAC in relation to preheat due to high energy electron transport. Presents 2 tables and a diagram.

39043 **Investigation of highly ionized plasma plumes generated by CO_2 laser irradiation of solid targets in strong axial magnetic fields.** Crawford, E.A.; Hoffman, A.L. (Mathematical Sciences Northwest, Inc. 2755 Northup Way Bellevue, Washington 98008). pp 353-367 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract AC08-81DP40154.

This chapter demonstrates the technique of creating uniform plasma conditions using laser irradiation and magnetic confinement. Topics covered include absorption near critical density, absorption in magnetically confined plume, radiative losses, a plasma plume technique, a plasma diagnostic apparatus, instrumentation for XUV-spectroscopy, results of plasma characterization experiments, and time resolved spectroscopic results (C^{4+} and C^{5+} ions). Plume formation is achieved by laser heating near the critical density and in a magnetically confined region. Scaling laws are derived to describe both processes. It is indicated that the strong temperature dependence of the laser absorption coefficient in a magnetically confined region results in very good radial uniformity. The temporal history of line radiation from recombining plasma plumes shows good agreement with results of modeling. Includes 2 photos and 2 diagrams.

39044 **High harmonic generation in high power lasers.** Grebogi, C.; Chen, H.H.; Tripathi, V.K. (Laboratory for Plasma and Fusion Energy Studies Univ. of Maryland College Park, MD 20742). pp 401-415 of Laser interaction and related plasma phenomena. Vol. 6. Hora, H.; Miley, G.H. New York, NY; Plenum Publishing Corp. (1984). Contract AS08-81DP40151.

This chapter examines the response of a strongly inhomogeneous plasma to a high power laser light as produced by the CO_2-laser Gemini and Helios systems. The response is studied in a continuous density gradient and then the generation of high harmonics in the laser produced plasmas is investigated. Fluid theory is used to derive a nonlinear and time-dependent differential equation describing the electron response in Lagrangian coordinates. Topics covered include derivation of the equation of motion, wavebreaking, and high harmonic generation. The fluid response of electrons in a steep density gradient to a p polarized powerful laser light is highly nonlinear. The source of a given high harmonic frequency is localized around the density region corresponding to a local plasma wave at that frequency. The intensity of the radiation coming out of the plasma is evaluated using the numerical results for the nonlinear current density. It is shown that the harmonic production efficiency is very high and the power densities of different harmonic are fairly constant over several harmonics.

39045 **Study on diffusion of the vertical magnetic field in the toroidal stabilizing shell and plasma of the ZT-40M reversed field pinch device.** Vogel, H.F.; Preis, H. (Los Alamos Nat'l. Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 6, 2482-2485(Nov 1983).

FEDIFF is a finite-element circuitnetwork code in which conductors are modeled in a three-dimensional (3-D) lattice of metal plates, each plate possessing finite thickness. The plates are properly interconnected and magnetically coupled to all external and internal circuit elements. The lattice is transformed to become circuit network, and to be integrated. The result of computations is discussed, in which FEDIFF solves 3-D vertical field diffusion problems in the toroidal stabilizing shell of the ZT-40M device at Los Alamos, when a vertical magnetic field is applied as a pulse. The stabilizing shell is made of aluminum, 2.2 cm thick, that is one skin depth at 110Hz. Because the shell is constructed with a poloidal insulated gap, the vertical magnetic field diffuses into the shell, differently in the gap region than elsewhere. With the existing aspect ratio of major to minor radius being six, we show that field diffusion in a straight cylinder exhibits virtually the same characteristics as the toroidal configuration does, away from the gap, provided the cylinder possesses the same wall thickness and material makeup as the toroidal shell. The accuracy of the present eddy current field calculations is 2.8%.

39046 **Optimization of a bundle divertor for the Fusion Engineering Device.** Hively, L.M.; Minkoff, M.; Rothe, K.E. (Oak Ridge National Laboratory General Electric Company/Fusion Engineering Design Center P.O. Box Y, Oak Ridge, Tennessee). *Nuclear Technology/Fusion;* **3**: No. 2, 280-286(Mar 1983).

Optimal double-T bundle divertor configurations have been obtained for the Fusion Engineering Device. On-axis ripple is minimized, while satisfying a series of engineering constraints. The ensuing nonlinear optimization problem is solved via a sequence of quadratic programming subproblems, using the VMCON software. The resulting divertor designs are substantially improved over previous configurations.

39047 **A simple computational form for Maxwellian reactivities.** Hively, L.M. (Oak Ridge National Laboratory General Electric Company/Fusion Engineering Design Center Oak Ridge, Tennessee). *Nuclear Technology/Fusion;* **3**: No. 2, 199-200(Mar 1983).

A simple form is given for the evaluation of Maxwellian reactivities for the reactions $T(d,n)^4He$, $D(d,p)T$, $D(d,n)^3He$, and $^3He(d,p)^4He$, with applications to the analytical treatment of fusion reactor problems.

39048 (ORNL-tr—5139) Study of model coils with the superconducting current-carrying element from the Tokamak-15 device. Ivanov, D.P.; Keilin, V.E.; Klimenko, E.Yu.; Kovalev, I.A.; Lelekhov, C.A.; Novikov, S.I.; Pekhterev, A.A.; Pozvonkov, M.M.; Posadskii, I.A.; Chernoplekov, N.A. (Oak Ridge National Lab., TN (USA); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. Contract AC05-84OR21400. Translation of IAE-3715/7, 1983. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013746.

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A study was made on the properties of a superconducting current-carrying element designed for the toroidal magnetic field coils of the T-15 device. It was shown that more degradation of the current-carrying capacity of the conductor occurred in model coils than in short samples because of mechanical damage to the material as it was produced and wound. An examination of the stability of the superconducting current-carrying element during pulsed disturbances in the magnetic field revealed that the relative orientation of the transport-current vector and the pulsed magnetic field vector as well as the state of the coolant influenced stability.

99 GENERAL AND MISCELLANEOUS

39049 (PB—84-187517) Mitsubishi technical review, Volume 21, Number 1, Series Number 59, February 84. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)). 1984. 24p. NTIS, PC E03/MF E01.

See also PB84-187525, PB84-187533, PB84-187541 and PB84-145051.

This issue contains these as follows: Corrosion Fatigue Behavior of Steel and Ti-6Al-4V in an industrial Gaseous Environment; Research on Central Receiver Solar Power Pilot Plant; Development of Three-Diminsional Numerical Analysis Method of Boiler Furnace Characteristics--Flow Analysis and Combustion and Heat Transfer Analysis; Development of New Sewage Pumps with High Efficiency; A Study on the Fabrication Method of Integrated Light Titanium Sheet Metal Structures by Superplastic Forming/Diffusion Bonding and New Passenger Car Galant Sigma. There are also several articles relating to new products.

9901 Management

REFER ALSO TO CITATION(S) 99010039076

39050 (ANL/TM—419) Using the purchase information reporting system at ANL. Moore, N.J.; Cha, B.C.K.; Cook, J.M. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015455.

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The Computing Services Division has assembled the tools and instituted the procedures that comprise the Purchase Information Reporting System (PIRS). PIRS allows all Wylbur users easy access to requisition data, purchase order data, and shipment arrival data processed through the Automated Materials/Payable System (AMPS). While AMPS is the Laboratory's official online computer system for automating the procurement cycle, access to AMPS is restricted to certain Laboratory personnel directly involved in the procurement process.

39051 (DOE/MA—0064/2-Vol.1) Fiscal Year 1985 Congressional budget request. Volume 1. Atomic energy defense activities. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Controller). Feb 1984. 654p. NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE84009776.

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Contents include: summaries of estimates by appropriation, savings from management initiatives, staffing by subcommittee, staffing appropriation; appropriation language; amounts available for obligation; estimates by major category; program overview; weapons activities; verification and control technology; materials production; defense waste and by-products management; nuclear safeguards and security; security investigations; and naval reactors development.

39052 (TVA/OACD—82/12) Tennessee Valley Authority, National Fertilizer Development Center progress 81. Parker, H. (ed.). (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). Mar 1982. 23p. NTIS, PC A02/MF A01. Order Number DE84901368.

39053 (TVA/OACD—84/4) Tennessee Valley Authority National Fertilizer Development Center progress 83. Parker, H. (ed.). (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). 1984. 32p. NTIS, PC A03/MF A01. Order Number DE84901364.

Highlights of past years and things happening now are discussed. Topics covered include: nitrogen efficiency, phosphate technology, ammonia from coal, new fertilizer processes, urea production, technology transfer, industry use of products, engineering assistance, demonstration farms, conserving soil, and renewable fuels.

39054 (ZfK—503) Joint annual report 1982. Hennig, K. (ed.). (Bergakademie Freiberg (German Democratic Republic). Sektion Physik; Friedrich-Schiller-Universitaet, Jena (German Democratic Republic). Sektion Physik; Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik; Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik; Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1983. 180p. (In English, German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84701641.

Results of research work carried out at the ZfK Rossendorf and other GDR institutions working in the field of nuclear physics are presented in individual summaries covering the following topics: nuclear reactions, spectroscopy and theory, applied methods of nuclear physics, accelerators, nuclear electronics.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 99020037345, 37541, 37678, 38109, 38261, 38286, 38883, 38983, 39050

39055 (AD-A—140780/8) High performance bulk memory system. Research report. Gropp, W.; O'Donnell, J.J.; O'Donnell, S.T.; Schultz, M.H.; Weston, B. (Yale Univ., New Haven, CT (USA). Dept. of Computer Science). Mar 1984. 11p. (YALEU/DCS/RR—311). NTIS, PC A02/MF A01.

We need a significant improvement in the technology of secondary memories. A bulk memory system with inexpensive memory doing fetches or writes in parallel (interleaving) provides one such technology. This interleaving is perfect for scientific computing in which one can usually design algorithms so that one need only access very long vectors in auxiliary storage. In these applications the effectiveness of the bulk memory is determined by the transfer rate. However, the bulk memory is even better suited for those problems, for example, as arise in commercial data processing, data base, and artificial intelligence applications, in which we wish to transfer small amounts of data. It is determined not by the transfer rate but by the latency and access time. In order to test the validity of our thesis, we have developed a bulk memory secondary storage device for a general-purpose supercomputer, the Floating Point Systems FPS-164. We present an overview of this system in Section 2. In Section 3, we describe the design philosophy of the interface to the FPS-164. To simplify the use of the bulk memory system, we have written a software system for the bulk memory which emulates a disk. This enables the user to use application software written to do I/O on a system with a peripheral disk virtually

unchanged. We present the details of our software design in Section 4. The FPS-164 is a moderately priced, fast central processing unit with fast I/O ports. While array processors such as the FPS-164 have traditionally been used for engineering and scientific computations, we feel the lessons we learn with this system will carry over to the applications and other high performance computers.

39056 **(AD-A—140851/7) Introduction to the Poker Parallel Programming Environment. Interim technical report.** Snyder, L. (Purdue Univ., Lafayette, IN (USA). Dept. of Computer Science). Aug 1983. 7p. NTIS, PC A02/MF A01.

Report on Project BLUE CHIP.

The Poker Parallel Programming Environment is a graphics-based, interactive system for programming the Configurable, High Parallel (CHiP) Computer. Designed to support nearly all aspects of parallel programming in one integrated system, Poker has been implemented as a (35,000 line) C program on the VAX 11/780 under UNIX. It provides a number of novel features including graphics programming of parallel processor communication.

39057 **(ANL—84-32) Mathematics and Computer Science Division activities, April 1, 1983-March 31, 1984.** Pieper, G.W. (ed.). (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014842.

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This report reviews the research activities in the Mathematics and Computer Science Division at Argonne National Laboratory for the period April 1, 1983 through March 31, 1984. The body of the report discusses various projects carried out in four major areas of research: applied analysis, computational mathematics, software engineering, and advanced scientific computing. The research computing facility is also briefly described. Information on section staff, visitors, workshops, and seminars is found in the appendices.

39058 **(ANL/TM—336-Rev.) Guide to computing at ANL.** Hinds, A.R.; Rivetna, R.R. (Argonne National Lab., IL (USA)). Jun 1984. Contract W-31-109-ENG-38. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84015555.

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This manual provides the computer user at Argonne National Laboratory with an overview of facilities and services available, recommends practices and modes of operation, and defines policies and priorities.

39059 (CERN—83-03, pp 4-24) **Algorithms and file structures for computational geometry.** Hinrichs, K.; Nievergelt, J. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Informatik). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

Algorithms for solving geometric problems and file structures for storing large amounts of geometric data are of increasing importance in computer graphics and computer-aided design. As examples of recent progress in computational geometry, we explain plane-sweep algorithms, which solve various topological and geometric problems efficiently; and we present the grid file, an adaptable, symmetric multi-key file structure that provides efficient access to multi-dimensional data along any space dimension.

39060 (CERN—83-03, pp 25-58) **Computing with linear equations and matrices.** Churchhouse, R.F. (University Coll., Cardiff (UK)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

Systems of linear equations and matrices arise in many disciplines. The equations may accurately represent conditions satisfied by a system or, more likely, provide an approximation to a more complex system of non-linear or differential equations. The system may involve a few or many thousand unknowns and each individual equation may involve few or many of them. Over the past 50 years a vast literature on methods for solving systems of linear equations and the associated problems of finding the inverse or eigenvalues of a matrix has been produced. These lectures cover those methods which have been found to be most useful for dealing with such types of problem. References are given where appropriate and attention is drawn to the possibility of improved methods for use on vector and parallel processors.

39061 (CERN—83-03, pp 59-65) **Introduction to computational complexity.** Churchhouse, R.F. (University Coll., Cardiff (UK)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

This single lecture, given as a seminar introduces the basic ideas which underlie the subject of computational complexity and illustrates some of the more commonly used techniques with a number of examples. Although the subject is of relatively recent origin there is a considerable research literature, but so far relatively few books treating the subject in depth have appeared.

39062 (CERN—83-03, pp 55-121) **Parallelism and array processing.** Zacharov, V. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

Modern computing, as well as the historical development of computing, has been dominated by sequential monoprocessing. Yet there is the alternative of parallelism, where several processes may be in concurrent execution. This alternative is discussed in a series of lectures, in which the main developments involving parallelism are considered, both from the standpoint of computing systems and that of applications that can exploit such systems. The lectures seek to discuss parallelism in a historical context, and to identify all the main aspects of concurrency in computation right up to the present time. Included will be consideration of the important question as to what use parallelism might be in the field of data processing.

39063 (CERN—83-03, pp 122-139) **Overview of interactive computer graphics and its application to computer-aided engineering and design.** Van Dam, A. (Brown Univ., Providence, RI (USA). Dept. of Computer Science). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

The purpose of this brief birds-eye view of interactive graphics is to list the key ideas, and to show how one of the most important application areas, Computer Aided Engineering/Design takes advantage of it.

39064 (CERN—83-03, pp 140-146) **Aspects of FORTRAN in large-scale programming.** Metcalf, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

In these two lectures I examine the following three questions: i) Why did high-energy physicists begin to use FORTRAN. ii) Why do high-energy physicists continue to use FORTRAN. iii) Will high-energy physicists always use FORTRAN. In order to find answers to these questions, it is necessary to look at the history of the language, its present position, and its likely future, and also to consider its manner of use, the topic of portability, and the competition from other languages. Here we think especially of early competition from ALGOL, the more recent spread in the use of PASCAL, and the appearance of a completely new and ambitious language, ADA.

39065 (CERN—83-03, pp 147-155) **Programming languages and support environments.** Buxton, J.N. (Warwick Univ., Coventry (UK)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

The author reviews the development of programming languager with special regards to FORTRAN and ALGOL 60.

39066 (CERN—83-03, pp 156-194) **Bus basics.** Dobinson, R.W. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

The aims of this course are: 1. To introduce the general concepts of buses used to interconnect processors, perpherals, and instrumentation. 2. To classify, albeit crudely, different types of bus systems. 3. To give some examples of past, present, and future buses as applied to the field of high-energy physics, including some details of software. 4. To provide references for further study.

39067 (CERN—83-03, pp 195-228) **Local area networks.** Pouzin, L. (Centre National d'Etudes des Telecommunications (CNET), 92 - Issy-les-Moulineaux (France)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

This paper is a series of comments with companion diagrams presented at the '82 CERN School of Computing.

39068 (CERN—83-03, pp 237-270) **Programmable digital microcircuits. A survey with examples of use.** Verkerk, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

The author presents a review about microprocessors.

39069 (CERN—83-03, pp 330-338) **Use of personal computers for self-teaching.** Levrat, B. (Geneva Univ. (Switzerland)). 2 May 1983. NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780234. (CONF-8208173—).

From CERN school of computing; Zinal, Switzerland (29 Aug 1982).

The number of personal computers is growing at a phenomenal rate. Their capabilities in man-machine interaction makes them useful in teaching a variety of subjects. They can offer a stimulating presentation of the material to be learned, varied drill and practice exercices and simulations. Testing, evaluation and progress monitoring are also possible. Key issues about quality and content should not be left to businessmen alone. At CERN, Computer Aided Learning could be useful in connexion with large experiments.

39070 (CONF-8404152—2) **Evaluating a scientific workstation computer.** Raffenetti, R.C. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014764.

From 25. Association for Energy Systems, Operations and Programming conference; Seattle, WA, USA (30 Apr 1984).

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This presentation describes the experiences we have had at Argonne National Laboratory in evaluating a Scientific Workstation Computer.

39071 (DOE/ER/10473—T3) **Data flow computer architecture.** (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Computer Science). 1 Jun 1984. Contract AC02-79ER10473. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84014362.

This is a report on work on the design of a processing cluster for a high-performance data flow computer, continued work on algorithms for compiling programs from the Val programming language. Study of design methodologies for use in developing specifications of hardware components for a prototype machine, and specification of trial device designs for the custom circuits needed to construct high-performance data flow computers.

39072 (DOE/ET/29104—1) **Singular perturbations, coherency and aggregation of dynamic systems.** (General Electric Co., Schenectady, NY (USA)). Sep 1983. Contract AC05-77ET29104. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014166.

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In this report a time-scale modeling methodology based on singular perturbation technique has been developed. In contrast to most of the previous research on singular perturbations which focuses only on the asymptotic aspect of the method, that is, the validity of the reduced model approximation as the singular perturbation parameter goes to zero, the methodology exploits system properties in defining subsystems and their hierarchies. The resulting reduced models are physically meaningful and hence would give insights to the pattern of dynamic interactions present in the system, thus providing a new departure point for control system design.

39073 (DOE/RA/50420—T1) **Frequency response design methods for large scale systems. Final report.** Levine, W.S.; Krishnaprasad, P.S.; Wang, Shih Ho. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). 1983. Contract AC01-80RA50420. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84014161.

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The main idea behind this project was to try to extend the existing techniques for the design of control systems in two ways. First, there are several good methods for designing centralized linear feedback controllers for linear multivariable systems. These methods are limited to systems with relatively few inputs and outputs. Thus, one of our major efforts was to develop techniques whereby these design methods could be extended so as to be applicable to large scale systems. Second, there are a number of concepts that are fundamental to the above-mentioned design procedures for linear systems. Two of the most important of these are the concepts of canonical forms and observers. Thus our second major effort was to develop equivalent concepts of observers and canonical forms for nonlinear systems.

39074 (EGG-ED—6662) **EG and G Idaho's response to a request for a graphic data base support package.** Rafferty, P.; Anderson, B. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1984. Contract AC07-76ID01570. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84015171.

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This paper is intended to provide an overview of existing graphics and data acquisition capabilities along with some current thinking on a Modular Integrated Data Acquisition and Control System (MIDACS). Experiences in the integration of the various acquisition, display and analysis packages will be related as well. Applications described within this response address enhancements to the Existing Westinghouse Hanford Company System.

39075 (EUR—8707) **Computer aided fault tree synthesis.** Poucet, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84701631.

Nuclear as well as non-nuclear organisations are showing during the past few years a growing interest in the field of reliability analysis. This urges for the development of powerful, state of the art methods and computer codes for performing such analysis on complex systems. In this report an interactive, computer aided approach is discussed, based on the well known fault tree technique. The time consuming and difficut task of manually constructing a system model (one or more fault trees) is replaced by an efficient interactive procedure in which the flexibility and the learning process inherent to the manual approach are combined with the accuracy in the modelling and the speed of the fully automatical ap-

proach. The method presented is based upon the use of a library containing component models. The possibility of setting up a standard library of models of general use and the link with a data collection system are discussed. The method has been implemented in the CAFTS-SALP software package which is described shortly in the report.

39076 **(HEDL-SA—3129-FP) Experience with a sophisticated computer based authoring system.** Gardner, P.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1984. Contract AC06-76FF02170. 8p. (CONF-840539—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014644.

From 25. annual ADCIS conference; Columbus, OH, USA (14 May 1984).

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In the November 1982 issue of ADCIS SIG CBT Newsletter the editor arrives at two conclusions regarding Computer Based Authoring Systems (CBAS): (1) CBAS drastically reduces programming time and the need for expert programmers, and (2) CBAS appears to have minimal impact on initial lesson design. Both of these comments have significant impact on any Cost-Benefit analysis for Computer-Based Training. The first tends to improve cost-effectiveness but only toward the limits imposed by the second. Westinghouse Hanford Company (WHC) recently purchased a sophisticated CBAS, the WISE/SMART system from Wicat (Orem, UT), for use in the Nuclear Power Industry. This report details our experience with this system relative to Items (1) and (2) above; lesson design time will be compared with lesson input time. Also provided will be the WHC experience in the use of subject matter experts (though computer neophytes) for the design and inputting of CBT materials.

39077 **(ITEF—108(1983)) On-line control system for acquisition of the annihilation photon angular distribution spectra.** Kudinov, V.I.; Sidorin, I.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701632.

The on-line system for acquisition of the annihilation photon angular distribution spectra controlled by the "DZ-28 Elektronika" computer, allowing one to fix basic angular spectrum parameters (coincidences, incidental coincidence background, by-channel loadings) in machine-readable form (on magnetic tape and punched tape), is described. It is possible to set an arbitrary measuring time for each spectrum point that permits to optimize the experiment procedure. The system programming simplicity makes it flexible that is necessary for the investigation of different classes of substances. The unitized system structure makes it possible to increase its functional abilities. The control may be realized using different computers by means of the corresponding interfaces.

39078 **(ITEF—114(1982)) Some additional potentialities of the TPIFOB program.** Vostrikov, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701633.

Some additional potentialities are described when operating with the "TRIF0B" code intended for calculation of spatial variation in the isotope composition and physical characteristics of a reactor cell during burn-up. The spectrum interpolation in a two-group representation between the values at the initial and final points of each time interval is introduced into the new option of the Code. The code accounts for the (n, 2n) reaction and calculation of the multiplication factor from interpolated values of process rates. Some advantages of the new option of the code are demonstrated for particular examples.

39079 **(ITEF—150(1982)) NICRO microprogramming language for sectional microprocessors.** Semenov, Yu.A.; Chudakov, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84701634.

"MICRO" microprogramming input language developed for sectional microprocessors is described. The structure of micromanual, purpose of particular fields, the corresponding mne– mocodes and requirements they have to meet are considered. Program for integer division with a sign written in the "MICRO" language is given as an example. The possibilities of modif ying the translator for its adaptation to different types of processor and microprocessor sets are analyzed.

39080 **(LA—10104-M) User's guide to sensitivity testing on computer models at Los Alamos National Laboratory.** Williams, D.S. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015067.

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This manual provides the user with a step-by-step procedure to use sensitivity testing on computer simulation models based upon the Dynamo programming language. The first step of the testing procedure is deciding which input parameters to use, the output variables needed, and the time span of the model to be tested. The Latin hypercube sampling program is run using all these parameters to determine the sample which will be modeled. The reruns from the sample are entered in a data file that is transferred to the Dartmouth Time-Sharing System and appended to the end of the Dynamo model. This model is then transferred back to a VAX system. Programs specifically designed for these simulation models are used to produce time-series plots, cross plots, and time plots of summary statistics and significant coefficients. These plots are used by the modeler to determine what effect the input parameters had on the output variables. Included in this manual are examples of the steps needed to produce the model and examples of the plots and tables used for interpretation.

39081 **(LA—10141-MS) ZTL: a subroutine package for the IBM personal computer to support the Ziatech ZT1488 IEEE-488 controller.** McGirt, F.; Moore, K. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015093.

The ZTL subroutine package is a set of assembly language subroutines that are callable from Supersoft FORTRAN and provide direct access to the Ziatech IEEE-488 interface hardware. These routines provide functions that are normally available only from assembly language and allow the programmer greater capability when using Supersoft FORTRAN. This is especially important in the development of applications programs that interface directly to hardware.

39082 **(LA—10142-MS) DOS 21: PCDOS 2.0 support subroutine package for the IBM personal computer.** McGirt, F. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015085.

The DOS21 subroutine was developed to provide direct access to selected PCDOS 2.0 system calls from Supersoft FORTRAN. These system calls, which are normally available only from assembly language, allow the programmer greater capability when using Supersoft FORTRAN. This is especially advantageous in the development of programs that interface directly to hardware.

39083 **(LA—10143-MS) REMOTE: Modem Communicator Program for the IBM personal computer.** McGirt, F. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015047.

REMOTE, a Modem Communicator Program, was developed to provide full duplex serial communication with arbitrary remote computers via either dial-up telephone modems or direct lines. The latest version of REMOTE (documented in this report) was developed for the IBM Personal Computer.

39084 **(LA—10144-MS) HGRAPH. A subroutine package for the IBM personal computer to support the Hercules Graphics card.** McGirt, F. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84015086.

The HGRAPH subroutine package is a set of assembly language subroutines. They are callable from Supersoft FORTRAN and provide direct access to the Hercules Graphics firmware. These routines provide functions normally available only from assembly language and allow the programmer greater capability when using Supersoft FORTRAN.

39085 **(LA—10145-MS) TRAINO: a subroutine package for the IBM personal computer to support the Transiac 6002 CAMAC crate controller.** McGirt, F. (Los Alamos National Lab., NM (USA)). Jun 1984. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84015091.

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The TRANIO subroutine package is a set of assembly language subroutines that are callable from Supersoft FORTRAN and provide direct access to Transiac CAMAC interface hardware. These routines provide functions that are normally available only from assembly language and allow the programmer greater capability when using Supersoft FORTRAN. This is especially important in the development of application programs that interface directly to hardware.

39086 **(PNL-SA—7585) TRAN-STAT: statistics for environmental transuranic studies, No. 7.** (EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group). Mar 1979. Contract AC06-76RL01830. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84014914.

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This issue of TRAN-SAT is concerned with estimating the mean and standard deviation of the underlying population from which data sets that contain less-than detectable concentrations, zeros, unreported concentrations below the detection limit and negative concentrations are drawn. Two specific types of data sets are discussed. One type is characterized by the absence of net concentration data less than a lower limit called the threshold value x_0. All net concentrations greater than x_0 are assumed to be present and available for statistical analysis. The other type of data set discussed may contain both positive and negative concentrations, but no unreported or less than detectable values. 35 references, 11 figures, 3 tables.

39087 **(SAND—83-2639) RSCORS graphics system.** Padilla, G.C.; Thompson, S.L. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1984. Contract AC04-76DP00789. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84015693.

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RSCORS is a powerful computer graphics system in the form of a user-callable FORTRAN library. The system is flexible, portable and nonproprietary. Routines are available for both two- and three-dimensional projections, black/white and color applications, contours and many other general situations. The system is currently available for CRAY, CDC, and VAX computers. This document describes version 2.0.

39088 **(SAND—84-0572) Halfspace representations of extrusions, solids of revolution, and pyramids.** Peterson, D.P. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1984. Contract AC04-76DP00789. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84015005.

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It is shown that the region bounded by an arbitrary polygon of n sides may be represented by a binary tree with n leaves, each of which is a planar halfspace that is associated with a side of the polygon, whose interior nodes are either regularized set intersections or unions. This representation is used to obtain binary tree representations for extrusions, solids of revolution, and pyramids.

39089 **(UCRL—89992) Security mechanisms in LINCS.** Nessett, D.M. (Lawrence Livermore National Lab., CA (USA)). 16 Nov 1983. Contract W-7405-ENG-48. 10p. (CONF-8311173—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84013509.

From 6. DOD/NBS computer security conference; Gaithersburg, MD, USA (15 Nov 1983).

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LINCS is a distributed operating system currently being implemented at Lawrence Livermore National Laboratory to support multi-security-level, multi-compartment distributed applications. Aspects of its architecture that relate to distributed system security are briefly discussed.

39090 **(UCRL—90477) Storage in the LLNL Octopus network: an overview and reflections.** Coleman, S.; Watson, R. (Lawrence Livermore National Lab., CA (USA)). 28 Feb 1984. Contract W-7405-ENG-48. 7p. (CONF-840665—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84014711.

From 6. IEEE symposium on mass storage systems; Vail, CO, USA (4 Jun 1984).

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The paper reviews the environment and characteristics of the central storage system at the Lawrence Livermore National Laboratory Computation Center. It then discusses some lessons learned from the successes and problems during 15 years of experience with this system and finally indicates some future directions.

39091 **Calculation of trigonometric fourier coefficients.** Lyness, J.N. (Mathematics and Computer Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Computational Physics;* **54**: No. 1, 57-73(Apr 1984). Contract W-31-109-ENG-38.

A method for the numerical evaluation of trigonometric Fourier coefficients is described. This method is suitable for sufficiently smooth functions and is essentially a modification of the standard method based on trapezoidal rule sums using, optionally, the fast Fourier transform.

9903 Information Handling

REFER ALSO TO CITATION(S) 99030037317, 37369

39092 **(DOE/ER/10977—T4) Vertical compression algorithms for sequentially processed statistical files.** Batory, D.S. (Florida Univ., Gainesville (USA). Dept. of Computer and Information Sciences). 1984. Contract AS05-81ER10977. 23p. NTIS MF A01; 2; GPO Dep. Order Number DE84015040.

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Horizontal data compression eliminates redundancies or regularities that occur within individual records. Suppression of trailing blanks and leading zeros are examples. Vertical compression eliminates regularities that occur across consecutively stored records. Prefix and suffix compression are examples. Two new vertical compression algorithms, VRE and HVRE, are presented in this paper. They are based on a combination of character matrix transposition (where rows are initially identified with records) and horizontal compression algorithms (run-length encoding and Huffman encoding). Experimental and theoretical results are presented that show the performance of VRE and HVRE is superior to that of some reputable commercial algorithms. Specifically, these are the compression algorithms of the ADABAS, IDMS and SHRINK/2 data management systems. VRE and HVRE are best suited for compressing statistical files which are sequentially processed and batch updated. They may also be used for file archival and for compressing randomly processed files as well.

39093 **(DOE/ER/10977—T5) Complex data types and a data manipulation language for scientific and statistical databases.** Brown, V.A. (Florida Univ., Gainesville (USA)). 1982. Contract AS05-81ER10977. 124p. NTIS MF A01; 2; GPO Dep. Order Number DE84015335.

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Existing database management systems (DBMSs) support only a few primitive data types: simple numerics and character strings. For scientific and statistical databases (SSDs), which require extensive data manipulation, many more data types need to be recognized. Currently, an SSD user must perform the necessary operations through application programs outside of the DBMS. Not only is this a burden to the user, but the system has no control over whether the operations performed are semantically valid. A solution to this problem is to directly support an extended set of data types. A complex data type (CDT) is a structured data type which corresponds to an abstract object commonly found in the user's view of data. We propose that a DBMS for SSD processing should recognize the following CDTs: set, vector, ordered set, matrix, time, time series, text, and generalized relation. In this thesis CDTs are defined and a language is developed specifically for SSD processing using CDTs as a basis.

39094 **(DOE/ER/10977—T6) Technique to model and design physical database systems.** Wise, T.E. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). Dec 1983. Contract AS05-81ER10977. 105p. NTIS MF A01; 2; GPO Dep. Order Number DE84015337.

Microfiche only, copy does not permit paper copy reproduction; Thesis.

Database management systems (DBMSs) allow users to define and manipulate records at a logical level of abstraction. A logical record is not stored as users see it but is mapped into a collection of physical records. Physical records are stored in file structures managed by a DBMS. Likewise, DBMS commands which appear to be directed toward one or more logical records actually correspond to a series of operations on the file structures. The structures and operations of a DBMS (i.e., its physical architecture) are not visible to users at the logical level. Traditionally, logical records and DBMS commands are mapped to physical records and operations in one step. In this report, logical records are mapped to physical records in a series of steps over several levels of abstraction. Each level of abstraction is composed of one or more intermediate record types. A hierarchy of record types results that covers the gap between logical and physical records. The first step of our technique identifies the record types and levels of abstraction that describe a DBMS. The second step maps DBMS commands to physical operations in terms of these records and levels of abstraction. The third step encapsulates each record type and its operations into a programming construct called a module. The applications of our technique include modeling existing DBMSs and designing the physical architectures of new DBMSs. To illustrate one application, we describe in detail the architecture of the commercial DBMS INQUIRE.

39095 **(JEN—551) Code Rex to fit experimental data to exponential functions and graphics plotting.** Travesi, A.; Romero, L. (Junta de Energia Nuclear, Madrid (Spain)). 1983. 58p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84702577.

FORTRAN IV.

The "Rex" code, written in Fortran IV, performs the fitting of a set of experimental data to different kinds of functions such as: a straight line (Y=A+BX), and various exponential types (Y=A Bsup(x), Y=A Xsup(B); Y=A exp(BX)), using the Least Squares criterion. Such fitting could be done directly for one selected function or for the four simultaneously, and allows one to choose the function that best fits the data, since the code presents the statistics data of all the fits. Further, it presents the graphics plotting, of the fitted function, in the appropriate coordinate system. An additional option allows also the Graphic plotting of experimental data used for the fitting. All the data necessary to execute this code are asked of the operator on the terminal screen in the interactive mode by screen-operator dialogue, and the values are introduced through the keyboard. This code can be executed on any computer provided with a graphic screen and keyboard terminal, with an X-Y plotter serial connected to the graphics terminal.

39096 **(PNL—5190) Executive information system.** Vitullo, M.; Winter, C.; Johnson, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84015355.

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The Executive Information System (EIS) is a computer-based information handling system. The system has been designed and implemented for Energy Conversion and Utilization Technologies to allow program managers easy access and tracking of certain types of reporting at various levels of management interaction, to simplify the handling of program-related data, and to streamline the preparation of reporting documents and responses to requests for information from the program. The EIS is especially useful in assisting DOE program managers in the routine dissemination of reports and information. The characteristics of each component of the EIS are discussed. A user's guide to the EIS is included in this report.

9904 Law

39097 **(INIS-mf—8977) Legal frame for the nuclear activities in Peru.** Romero M, G.L. (Instituto Peruano de Energia Nuclear, Lima). (Instituto Peruano de Energia Nuclear, Lima). 1983. 172p. (In Spanish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780481.

An annotated compilation is given of the legal regulations issued by Peru in the nuclear field between 1942 and 1982.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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	Plasma Phys., 26: No. 1, 133-144(Jan 1984)			9:38982
CONF-830910-	(3. national conference on synchrotron radiation instrumentation, Upton, NY, USA, 12-14 Sep 1983)			
14	*See* BNL-34300	DE84014379	MN -28	9:38227
CONF-830953-	(7. international solid state dosimetry conference, Ottawa, Canada, 27-30 Sep 1983)			
	Radiat. Prot. Dosim., 6: No. 1-4, 221-224(1984)			9:38898
	Radiat. Prot. Dosim., 6: No. 1-4, 265-268(1984)			9:38899
CONF-830969-	(12. international conference on solid state nuclear track detectors, Acapulco, Mexico, 4-10 Sep 1983)			
	See INIS-mf-8981	DE84780475	MN -34C	9:38293

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CONF-830995-	(11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection, Vienna, Austria, 20-24 Sep 1983)			
Summ.	*See* INIS-mf-9005	DE84780512	MN -46	9:38896
CONF-8309147-	(3. international workshop on plasma focus research, Stuttgart, F.R. Germany, 12-13 Sep 1983)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014816	MN -63	9:38923
CONF-8309239-	(11. international symposium on nuclear electronics, Bratislava, Czechoslovakia, 13-16 Sep 1983)			
1	*See* JINR-10-83-382	DE84701562	MN -28	9:38240
CONF-831015-	(Nuclear science symposium, San Francisco, CA, USA, 19-21 Oct 1983)			
	IEEE Trans. Nucl. Sci., 31: No. 1, 780-785(Feb 1984)			9:38337
	IEEE Trans. Nucl. Sci., 31: No. 1, 801-803(Feb 1984)			9:38338
	IEEE Trans. Nucl. Sci., 31: No. 1, 771-775(Feb 1984)			9:38339
	IEEE Trans. Nucl. Sci., 31: No. 1, 795-800(Feb 1984)			9:38340
	IEEE Trans. Nucl. Sci., 31: No. 1, 786-790(Feb 1984)			9:38341
	IEEE Trans. Nucl. Sci., 31: No. 1, 791-794(Feb 1984)			9:38342
	IEEE Trans. Nucl. Sci., 31: No. 1, 281(Feb 1984)			9:38343
	IEEE Trans. Nucl. Sci., 31: No. 1, 776-779(Feb 1984)			9:38363
	IEEE Trans. Nucl. Sci., 31: No. 1, 553-555(Feb 1984)			9:38538
	IEEE Trans. Nucl. Sci., 31: No. 1, 521-526(Feb 1984)			9:38539
	IEEE Trans. Nucl. Sci., 31: No. 1, 538-542(Feb 1984)			9:38540
	IEEE Trans. Nucl. Sci., 31: No. 1, 533-537(Feb 1984)			9:38541
	IEEE Trans. Nucl. Sci., 31: No. 1, 527-532(Feb 1984)			9:38542
	IEEE Trans. Nucl. Sci., 31: No. 1, 381-386(Feb 1984)			9:38543
	IEEE Trans. Nucl. Sci., 31: No. 1, 516-520(Feb 1984)			9:38544
	IEEE Trans. Nucl. Sci., 31: No. 1, 230-235(Feb 1984)			9:38545
	IEEE Trans. Nucl. Sci., 31: No. 1, 585-589(Feb 1984)			9:38546
	IEEE Trans. Nucl. Sci., 31: No. 1, 548-552(Feb 1984)			9:38547
	IEEE Trans. Nucl. Sci., 31: No. 1, 679-681(Feb 1984)			9:38607
	IEEE Trans. Nucl. Sci., 31: No. 1, 766-770(Feb 1984)			9:38683
	IEEE Trans. Nucl. Sci., 31: No. 1, 896-899(Feb 1984)			9:38891
	IEEE Trans. Nucl. Sci., 31: No. 1, 504-508(Feb 1984)			9:38976
	IEEE Trans. Nucl. Sci., 31: No. 1, 490-494(Feb 1984)			9:39037
CONF-831070-	(IEEE/IAS glass industry committee meeting, Mexico City, Mexico, 3-7 Oct 1983)			
2-Rev.1	*See* UCRL-89356-Rev.1	DE84014714	MN -38	9:38111
CONF-8310143-	(11. NRC water reactor safety research information meeting, Gaithersburg, MD, USA, 14-24 Oct 1983)			
Vol.3	*See* NUREG/CP-0048-Vol.3	DE84900511	MN -78	9:37694
CONF-8310261-	(International conference on physics and technique of low temperature, Varna, Bulgaria, 1 Oct 1983)			
1	*See* JINR-R-8-83-159	DE84701553	MN -28	9:38357
CONF-831123-	(Eastern oil shale symposium, Lexington, KY, USA, 13-16 Nov 1983)			
1	Institute of Gas Tech., 3424 South State St., Chicago, IL 60616	TI84901426	MN -91	9:37212
CONF-8311110-	(6. workshop on environmental research for actinide elements, Hilton Head Island, SC, USA, 7-11 Nov 1983)			
5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014761	MN -11	9:38460
CONF-8311173-	(6. DOD/NBS computer security conference, Gaithersburg, MD, USA, 15-17 Nov 1983)			
1	*See* UCRL-89992	DE84013509	MN -32	9:39089
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
164	*See* GA-A-17203	DE84013557	MN -20	9:39013
165	*See* GA-A-17225	DE84013556	MN -20	9:39016
166	*See* GA-A-17204	DE84013555	MN -20	9:39014
167	*See* GA-A-17199	DE84013554	MN -20	9:39012
168	*See* GA-A-17205	DE84013654	MN -20	9:39015
CONF-831205-	(6. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 12-14 Dec 1983)			
	Alternative Energy Sources, 438(Dec 1983)			9:37083
	Alternative Energy Sources, 490-493(Dec 1983)			9:37123
	Alternative Energy Sources, 575-577(Dec 1983)			9:37399
CONF-831264-	(Workshop on accelerator physics issues for a superconducting super collider, Ann Arbor, MI, USA, 12-17 Dec 1983)			
16	*See* LBL-17805	DE84014532	MN -34D	9:38219
CONF-831272-	(EHV systems assessment seminar, Gainesville, FL, USA, 14-15 Dec 1983)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014759	MN -96	9:37734
CONF-840107-	(4. advanced coal cleaning conference, Santa Barbara, CA, USA, 8-13 Jan 1984)			
Absts.	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014183	MN -90b	9:37149
CONF-840111-	(8. annual symposium on energy from biomass and wastes, Lake Buena Vista, FL, USA, 30 Jan-3 Feb 1984)			
8	Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616	TI84901427	MN -61E	9:37402
CONF-840120-	(4. symposium on atomic and surface physics, Hintermoos, Austria, 29 Jan-4 Feb 1984)			
	See INIS-mf-9006	DE84780511	MN -34D	9:38704
CONF-840154-	(PSSC fixed target workshop, Woodland, TX, USA, 27-29 Jan 1984)			
3	*See* LBL-18026	DE84014583	MN -28	9:38186

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CONF-840264-	(Workshop on high energy excitations in condensed matter, Los Alamos, NM, USA, 13-15 Feb 1984)			
6	*See* BNL-34966	DE84014565	MN -34D	9:38228
CONF-840280-	(Recontre de Moriond meeting on electro weal interactions and unified theories, La Plaque, France, 26 Feb-4 Mar 1984)			
9	*See* BNL-34910	DE84014349	MN -34D	9:38737
CONF-840311-	(4. international symposium on heating in toroidal plasmas, Rome, Italy, 21-28 Mar 1984)			
14	*See* PPPL-2118	DE84015148	STD -20f	9:38943
CONF-840325-	(Winter national meeting of the American Institute of Chemical Engineers, Atlanta, GA, USA, 11-14 Mar 1984)			
4	Inst of Gas Tech., 3424 South State St., Chicago, IL 60616	TI84901423	MN -90	9:37038
CONF-840396-	(International conference on instrumentation for colliding beam physics, Novosibirsk, USSR, 15-21 Mar 1984)			
6	*See* SLAC-PUB-3314	DE84014337	MN -28	9:38224
CONF-8403121-	(New particle production at high energy meeting: The Recontre de Moriond, La Plagne, France, 4-10 Mar 1984)			
5	*See* ANL-HEP-CP-84-18	DE84014539	MN -34D	9:38762
6	*See* LBL-17867	DE84014593	MN -34D	9:38734
CONF-840408-	(5. international conference on nuclear methods in environmental and energy research, Mayaguez, Puerto Rico, 2-6 Apr 1984)			
16	*See* BNL-NUREG-34824	DE84014383	MN -79p	9:37661
17	*See* BNL-34892	DE84014390	MN -48	9:38481
CONF-840415-	(187. national meeting of the American Chemical Society, St. Louis, MO, USA, 8-13 Apr 1984)			
26	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014536	MN -4	9:38011
CONF-840440-	(86. annual meeting and exposition of the American Ceramic Society, Pittsburgh, PA, USA, 29 Apr-3 May 1984)			
3	*See* DP-MS-83-133	DE84013957	MN -70	9:37278
CONF-840484-	(ANS student/professional conference on nuclear science and engineering, College Station, TX, USA, 6-7 Apr 1984)			
1	*See* LBL-17789	DE84014608	MN -4	9:37404
CONF-8404143-	(10. international conference on cyclotrons and their applications, East Lansing, MI, USA, 30 Apr-3 May 1984)			
8	*See* LBL-17086	DE84014587	MN -28	9:38265
CONF-8404152-	(25. Association for Energy Systems, Operations and Programming conference, Seattle, WA, USA, 30 Apr-4 May 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014764	MN -32	9:39070
CONF-8404154-	(Workshop on prospects for research with radioactive beams from heavy-ion accelerators, Washington, DC, USA, 26-27 Apr 1984)			
2	*See* LBL-17829	DE84013396	MN -28	9:38267
CONF-8404173-	(Workshop on high heat flux materials for TFCX, Germantown, MD, USA, 17-18 Apr 1984)			
	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84014813	MN -20c	9:39004
CONF-840512-	(6. congress of the International Radiation Protection Association, Berlin, F.R. Germany, 7-12 May 1984)			
16	*See* TRI-PP-84-37	DE84901473	MN -34D	9:38272
CONF-840520-	(6. international conference on plasma surface interactions in controlled fusion devices, Nagoya, Japan, 14-18 May 1984)			
10	*See* SAND-84-1135C	DE84013802	MN -20d	9:39028
11	*See* GA-A-17585	DE84013842	MN -20a	9:39018
12	*See* GA-A-17576	DE84013841	MN -20d	9:38933
13	*See* GA-A-17557	DE84013840	MN -20a	9:39017
17	*See* DOE/ER/52062-6	DE84015016	STD -20a	9:38924
CONF-840529-	(Linear accelerator conference, Darmstadt-Seeheim, F.R. Germany, 7-11 May 1984)			
39	*See* LBL-17788	DE84013395	MN -21	9:39023
40	*See* UCRL-90242	DE84013205	MN -28	9:38225
41	*See* LBL-17685	DE84013239	MN -28	9:38266
CONF-840539-	(25. annual ADCIS conference, Columbus, OH, USA, 14-18 May 1984)			
2	*See* HEDL-SA-3129-FP	DE84014644	MN -32	9:39076
CONF-840570-	(Materials for future energy systems conference, Washington, DC, USA, 1-3 May 1984)			
9	*See* LBL-17442	DE84014585	MN -25	9:37939
CONF-840576-	(International symposium on circuits and systems - ISCAS'84, Montreal, Canada, 7-10 May 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013873	MN -97c	9:37500
CONF-8405124-	(4. annual contractors' meeting on contaminants in hot coal-derived gas streams, Morgantown, WV, USA, 15-17 May 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014739	MN -90	9:37153
CONF-8405168-	(International colloquium on group theoretical methods in physics, College Park, MD, USA, 21-25 May 1984)			
2	*See* LBL-17976	DE84014576	MN -20g	9:38938
CONF-8405193-	(Conference on the intersections between particle and nuclear physics, Steamboat Springs, CO, USA, 23-30 May 1984)			
23	*See* DOE/ER/13065-390	DE84014623	MN -34D	9:38743
26	*See* BNL-34913	DE84014569	MN -28	9:38162
27	*See* BNL-34936	DE84014563	MN -34D	9:38738
28	*See* BNL-34995	DE84014567	MN -34B	9:38663
29	*See* LBL-17990	DE84014594	MN -34C	9:38185

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30	*See* TRI-PP-84-42	DE84901472	MN -34D	9:38273
CONF-8405197-	(Synthesis of high energy materials meeting, Dover, NJ, USA, 1 May 1984)			
1	*See* LA-UR-84-2038	DE84014022	MN -45	9:38369
CONF-8405206-	(Meeting on fusion technology test facility, Karlsruhe, F.R. Germany, 29-30 May 1984)			
1	*See* UCRL-90825	DE84014702	MN -20	9:39034
CONF-8405207-	(Symposium on assessment of risk from low level exposure to radiation and chemicals, Upton, NY, USA, 20-23 May 1984)			
1	*See* UCRL-90841	DE84014706	MN -48	9:38622
CONF-840604-	(12. international symposium on effects of radiation on materials, Williamsburg, VA, USA, 18-20 Jun 1984)			
12	*See* HEDL-SA-3031-FP	DE84014647	MN -25	9:37931
14	*See* HEDL-SA-3002-FP	DE84014649	MN -79	9:37635
15	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014276	MN -48	9:38614
CONF-840610-	(Windows in building design and maintenance conference, Gothenburg, Sweden, 13-15 Jun 1984)			
2	*See* LBL-17429	DE84014610	MN -95d	9:37836
3	*See* LBL-17683	DE84014591	MN -95d	9:37837
CONF-840612-	(Air Pollution Control Association annual meeting, San Francisco, CA, USA, 25-28 Jun 1984)			
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014274	MN -11	9:38419
CONF-840614-	(Annual meeting of the American Nuclear Society, New Orleans, LA, USA, 3-8 Jun 1984)			
68	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014257	MN -79	9:37663
75	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014261	MN -11	9:38408
76	*See* DP-MS-83-125	DE84013962	MN -70	9:37277
78	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014295	MN -70	9:37351
80	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014289	MN -41	9:38376
82	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014278	MN -32	9:38883
84	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014294	MN -80	9:37624
85	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014293	MN -20d	9:39003
87	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014253	MN -78	9:37563
88	*See* HEDL-SA-3058-FP	DE84014556	MN -79b	9:37680
91	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014263	MN -78	9:37542
CONF-840616-	(International conference on plasma physics, Lausanne, Switzerland, 27 Jun-3 Jul 1984)			
18	*See* LA-UR-84-1976	DE84014033	MN -20f	9:38937
19	*See* LA-UR-84-2023	DE84014024	MN -20g	9:39021
CONF-840617-	(12. DOE surface science/SUBWOG - 7. SUBWOG - 12B technical exchange meeting, Oak Ridge, TN, USA, 11-14 Jun 1984)			
4	*See* UCRL-90569	DE84014480	MN -4	9:37718
CONF-840627-	(29. annual meeting of the Health Physics Society, New Orleans, LA, USA, 3-7 Jun 1984)			
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014079	MN -70B	9:37264
CONF-840629-	(13. international quantum electronics conference, Anaheim, CA, USA, 18-21 Jun 1984)			
5	*See* UCRL-90137	DE84013077	MN -21	9:39033
CONF-840633-	(25. US symposium on rock mechanics, Evanston, IL, USA, 25-27 Jun 1984)			
1	*See* UCRL-89960	DE84002718	MN -11	9:38657
CONF-840647-	(ASME pressure vessel and piping conference, San Antonio, TX, USA, 17-21 Jun 1984)			
23-Draft	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014280	MN -25	9:37921
CONF-840657-	(5. water chlorination conference, Williamsburg, VA, USA, 3-8 Jun 1984)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014081	MN -11	9:38451
CONF-840664-	(9. international congress on metallic corrosion, Toronto, Canada, 3-7 Jun 1984)			
7	*See* BNL-34978	DE84014560	MN -25	9:37623
CONF-840665-	(6. IEEE symposium on mass storage systems, Vail, CO, USA, 4-7 Jun 1984)			
2	*See* UCRL-90477	DE84014711	MN -32	9:39090
CONF-840688-	(5. international conference on finite elements in water resources, Burlington, VT, USA, 18-22 Jun 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014266	MN -11	9:38452
CONF-8406124-	(2. workshop on containment integrity, Washington, DC, USA, 13-15 Jun 1984)			
9	*See* IS-M-494	DE84014820	MN -80	9:37627
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014627	MN -80	9:37665
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014732	MN -78	9:37666
CONF-8406133-	(DARPA propagation meeting, Monterey, CA, USA, 18-22 Jun 1984)			
4	*See* SAND-84-1267C	DE84014054	MN -28	9:38269
CONF-8406137-	(16. power modulator symposium, Arlington, VA, USA, 17-20 Jun 1984)			
11	*See* LA-UR-84-1938	DE84014044	MN -20	9:39019
12	*See* LA-UR-84-1921	DE84013907	MN -28	9:38263
15	*See* BNL-34987	DE84014562	MN -28	9:38191
CONF-8406139-	(9. international CODATA conference, Jerusalem, Israel, 24-28 Jun 1984)			
5	*See* LBL-17886	DE84014570	MN -70	9:37317

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CONF-8406142-	(Hazardous materials management conference, Philadelphia, PA, USA, 5-7 Jun 1984)			
2	*See* PNL-SA-12316	DE84013263	MN -70	9:37323
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014052	MN -70	9:37265
CONF-8406143-	(18. annual conference on trace substances in environmental health, Columbia, MO, USA, 4 Jun-7 Apr 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014265	MN -11	9:38453
CONF-8406149-	(TRIUMF-ISOL workshop, Montreal, Canada, 13-15 Jun 1984)			
2	*See* LBL-17935	DE84014609	MN -34C	9:38268
3	*See* BNL-34940	DE84014698	MN -34C	9:38837
CONF-8406153-	(7. international conference on spectral line shapes, Aussois, France, 11-15 Jun 1984)			
1	*See* UCRL-90902	DE84013375	MN -20	9:38948
CONF-8406157-	(Conference on energy, power and environmental systems, San Francisco, CA, USA, 4-6 Jun 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014735	MN -95f	9:37880
CONF-840701-	(Topical meeting on fission product behavior and source term research, Snowbird, UT, USA, 15-19 Jul 1984)			
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014766	MN -78	9:37664
CONF-840712-	(21. IEEE annual conference on nuclear and space radiation effects, Colorado Springs, CO, USA, 22-25 Jul 1984)			
6	*See* SAND-84-1400C	DE84014083	MN -34A	9:37390
7	*See* SAND-84-1555C	DE84014985	MN -37	9:38351
8	*See* SAND-84-1335C	DE84014986	MN -37	9:38350
9	*See* SAND-84-0620C	DE84014990	MN -37	9:38349
CONF-840734-	(25. annual meeting of the Institute of Nuclear Materials Management, Columbus, OH, USA, 15-18 Jul 1984)			
3	*See* SAND-84-1434C	DE84014003	MN -16	9:37368
5	*See* SAND-84-0501C	DE84014055	MN -15	9:37365
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014724	MN -15	9:37356
7	*See* SAND-84-0286C	DE84014957	MN -80	9:37538
8	*See* SAND-84-0539C	DE84014989	MN -15	9:37367
9	*See* SAND-84-0538C	DE84014988	MN -15	9:37366
CONF-840757-	(22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984)			
3	*See* BNL-34932	DE84014375	MN -34D	9:38763
CONF-840804-	(Intersociety energy conversion engineering conference, San Francisco, CA, USA, 19-24 Aug 1984)			
29	*See* BNL-34837	DE84014559	MN -94cb	9:37397
CONF-840806-	(18. DOE nuclear airborne waste management and air cleaning conference, Baltimore, MD, USA, 13-16 Aug 1984)			
1	*See* GA-A-17634	DE84014693	MN -83	9:37292
CONF-840809-	(Geothermal Resources Council annual meeting, Reno, NV, USA, 27-29 Aug 1984)			
17	*See* LBL-17859	DE84014581	MN -66	9:37484
CONF-840813-	(Design, construction and operation of nuclear power plants conference, Portland, OR, USA, 5-8 Aug 1984)			
11	*See* HEDL-SA-3047-FP	DE84014648	MN -79	9:37650
12	*See* BNL-NUREG-34942	DE84014691	MN -78	9:37662
CONF-840816-	(22. national heat transfer conference, Niagara Falls, NY, USA, 5-8 Aug 1984)			
14	*See* BNL-34924	DE84014551	MN -38	9:38143
CONF-840853-	(International Society of Electrochemistry, Berkeley, CA, USA, 5-10 Aug 1984)			
7	*See* LBL-17852	DE84014588	MN -4	9:38035
CONF-840910-	(10. international conference on plasma physics and controlled nuclear fusion research, London, UK, 12-19 Sep 1984)			
2	*See* GA-A-17645	DE84014883	MN -20g	9:38934
CONF-840914-	(International meeting on thermal nuclear reactor safety, Karlsruhe, F.R. Germany, 10-14 Sep 1984)			
4	*See* SAND-84-0359C	DE84014956	MN -80	9:37716
CONF-840930-	(OCEANS '84 conference and exposition, Washington, DC, USA, 10-12 Sep 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014643	MN -64	9:37462
CONF-840981-	(11. international symposium on discharges and electrical insulation in vacuum, Berlin, F.R. Germany, 24-28 Sep 1984)			
2	*See* LA-UR-84-1939	DE84014043	MN -21	9:39020
CONF-8409102-	(EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics, St. Polten, Austria, 3-6 Sep 1984)			
2	*See* LA-UR-84-1794	DE84013893	MN -25	9:37967
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014642	MN -25	9:38033
CONF-8409104-	(59. annual Society of Petroleum Engineers of AIME technical conference, Houston, TX, USA, 16-19 Sep 1984)			
4	*See* SAND-84-0316C	DE84014987	MN -38	9:38117
COO-				
313-TA-366	*See* DOE/ER/03130-366	DE84013717	MN -34D	9:38765
1195-493	*See* DOE/ER/01195-T6	DE84015351	MN -34D	9:38740
1195-494	*See* DOE/ER/01195-T5	DE84015133	MN -34D	9:38739
2725-07	*See* DOE/EV/02725-T3	DE84013286	MN -48	9:38563
3130TB-258	*See* DOE/ER/03130-258	DE84013718	MN -34D	9:38742
3130TC-10	*See* DOE/ER/03130-10	DE84014106	MN -34D	9:38741
3130TC-12	*See* DOE/ER/03130-12	DE84014108	MN -34D	9:38281
3227-78	*See* DOE/ER/03227-78	DE84013476	MN -34D	9:38804

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CRREL-				
81-12	*See* AD-A-138426/2			9:37187
CSIR-S-				
325	NTIS (US Sales Only), PC A06/MF A01	DE84780441	MN -34B	9:38686
CSR-P-				
82-4	*See* N-8329158			9:38671
D-				
8:1984	*See* PB-84-167477			9:37839
DGMK-				
248	Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)			9:38366
DL/SCI/R-				
20	NTIS (US Sales Only), PC A04/MF A01	DE84780531	MN -34C	9:38229
DOE/AD/11139-				
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014429	MN -13	9:37738
DOE/AF/20004-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84010856	MN -61F	9:37412
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010855	MN -61	9:37413
DOE/BC/10216-				
13	NTIS, PC A07/MF A01 (GPO Dep.)	DE84012721	STD -92a	9:37201
DOE/BC/10525-				
8	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84015206	STD -91	9:37216
DOE/BETC/OR-				
23	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84012719	STD -92a	9:37174
DOE/BP-				
233	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013726	MN -98	9:37806
234	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84014171	MN -98	9:37807
235	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84014124	MN -98	9:37808
256	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84013591	MN -11	9:37619
DOE/CE-				
0023/ 3	NTIS, PC A06/MF A01 (GPO Dep.)	DE84014401	STD -95	9:37781
DOE/CE/15148-				
T7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014900	STD -95d	9:37881
DOE/CE/30784-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014428	MN -61A	9:37432
DOE/CE/50036-				
T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013612	MN -96	9:37913
DOE/CS/20441-				
3	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE84014855	MN -95d	9:37895
3-App.1	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84014854	MN -95d	9:37896
3-App.2	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84014393	MN -95d	9:37897
3-App.3	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84014534	MN -95d	9:37898
DOE/CS/30512-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013479	STD -58e	9:37464
DOE/CS/30576-				
T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015132	STD -59a	9:37465
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015130	STD -59a	9:37466
DOE/CS/30582-				
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014158	MN -59b	9:37467
DOE/CS/30589-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013614	MN -95d	9:37831
DOE/CS/31457-				
T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013385	STD -59b	9:37468
DOE/CS/40338-				
5	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014456	STD -92b	9:37107
DOE/CS/40402-				
T4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012880	STD -95f	9:37882
DOE/CS/51101-				
3	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84015319	MN -62	9:37456
DOE/CS/56051-				
10	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015205	STD -96	9:37854
DOE/CS/58435-				
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014305	MN -96	9:37855
DOE/DP/40169-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012210	MN -21	9:38129
DOE/EI/10422-				
T1-Vol.2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84015138	MN -98G	9:37777
T1-Vol.3	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84015140	MN -98G	9:37778
T1-Vol.4	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84015143	MN -98G	9:37779
DOE/EI/10691-				
T4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013464	MN -98	9:37739
DOE/EI/11972-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014209	MN -98F	9:37180
T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014211	MN -98F	9:37181
DOE/EIA-				
0035(84/ 04)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE84015303	MN -98F	9:37182
0095(83)	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84014811	MN -98E	9:37787
0109(84/ 05)	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84015304	MN -98B	9:37183
0130(84/ 05)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	DE84014786	MN -98C	9:37200
0226(84/ 04)	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	DE84014370	MN -98E	9:37788
0314(82)	NTIS, PC A11/MF A01; 1 - GPO (GPO Dep.)	DE84015224	MN -98	9:37809
0363(84)	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	DE84014371	MN -98A	9:37165
0397(84/ 1Q)	NTIS, PC A15/MF A01; 1 - GPO (GPO Dep.)	DE84014933	MN -98E	9:37789
0449	NTIS, PC A05/MF A01 - GPO (GPO Dep.)	DE84015178	MN -98	9:37209
0451	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84015023	MN -98A	9:37790

Report No.	Availability	Order No.	Distribution Category	Abstract No.
0493	NTIS, PC A06/MF A01 - GPO (GPO Dep.)	DE84013926	MN -98A	9:37171
DOE/ER-0147/ 1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015328	MN -48	9:38506
DOE/ER/00038-2574	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014938	MN -4	9:38087
DOE/ER/01195-T5	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015133	MN -34D	9:38739
T6	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015351	MN -34D	9:38740
DOE/ER/01560-18	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014888	MN -80	9:37647
DOE/ER/03130-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014671	MN -34D	9:38764
10	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84014106	MN -34D	9:38741
12	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014108	MN -34D	9:38281
258	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013718	MN -34D	9:38742
366	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013717	MN -34D	9:38765
DOE/ER/03227-78	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013476	MN -34D	9:38804
DOE/ER/03230-T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013520	MN -34D	9:38732
DOE/ER/03244-105	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014625	MN -34C	9:38807
DOE/ER/04356-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014352	MN -94cc	9:37735
DOE/ER/05002-40	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014368	MN -25	9:37915
DOE/ER/05226-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015025	MN -4	9:37414
DOE/ER/06027-14	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013448	MN -34A	9:38697
DOE/ER/10229-19	NTIS, PC A02; 3 (GPO Dep.)	DE84014926	MN -80	9:37648
DOE/ER/10438-8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014824	MN -34	9:37963
DOE/ER/10473-T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014362	MN -32	9:39071
DOE/ER/10538-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013701	MN -61G	9:37433
DOE/ER/10556-99	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014629	MN -25	9:37975
DOE/ER/10571-10	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014302	MN -25	9:37922
DOE/ER/10665-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014385	MN -48	9:38482
DOE/ER/10814-11	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015212	MN -25	9:37923
DOE/ER/10870-152	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014822	MN -25	9:37924
DOE/ER/10873-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84014620	MN -48	9:37434
DOE/ER/10941-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015436	MN -25	9:37925
DOE/ER/10972-T3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015134	MN -25	9:37926
DOE/ER/10977-T4	NTIS MF A01; 2 (GPO Dep.)	DE84015040	MN -32	9:39092
T5	NTIS MF A01; 2 (GPO Dep.)	DE84015335	MN -32	9:39093
T6	NTIS MF A01; 2 (GPO Dep.)	DE84015337	MN -32	9:39094
DOE/ER/12086-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014538	MN -48	9:38553
DOE/ER/12087-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014601	MN -48	9:38509
DOE/ER/12096-1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013449	STD -91	9:37213
DOE/ER/13065-390	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014623	MN -34D	9:38743
DOE/ER/13107-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014935	MN -48	9:38483
DOE/ER/40035-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014849	MN -37	9:38282
DOE/ER/40085-5	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84015437	MN -34D	9:38733
DOE/ER/45006-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015344	MN -25	9:37964
DOE/ER/45013-2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015112	MN -70	9:37266
DOE/ER/52062-6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015016	STD -20a	9:38924
T5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015255	MN -20a	9:38925
DOE/ER/52076-8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013794	MN -20f	9:39005
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013795	MN -20f	9:39006
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013755	MN -20f	9:39007
DOE/ER/52110-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014771	MN -25	9:37927

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/ER/53104-				
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014941	MN -20g	9:38926
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014939	MN -20g	9:38927
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014940	MN -20g	9:38928
DOE/ER/53135-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015217	MN -20f	9:38929
DOE/ER/53154-				
64	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015706	STD -20f	9:38930
67	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015113	STD -20f	9:38931
DOE/ER/60079-				
T6	NTIS MF A01; 2 (GPO Dep.)	DE84015236	MN -11	9:38385
DOE/ER/60095-				
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015254	MN -11	9:38409
DOE/ER/70004-				
315	NTIS MF A01; 2	DE82008365	MN -34D	9:38766
382	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013834	MN -34D	9:38792
DOE/ET/10393-				
1587	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009278	STD -90e	9:38114
1589	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009276	STD -90e	9:37501
DOE/ET/10679-				
T22	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014477	MN -90	9:37039
T23	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014787	MN -90	9:37040
DOE/ET/10682-				
13	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015342	MN -90h	9:37041
DOE/ET/10815-				
92	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014326	STD -90g	9:37817
DOE/ET/13513-				
T12	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015208	MN -25	9:37928
DOE/ET/14331-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013615	MN -91	9:37785
DOE/ET/14700-				
18	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013177	STD -90d	9:37042
DOE/ET/14880-				
T7	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013613	STD -90d	9:37043
DOE/ET/23034-				
T4	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84010338	MN -63	9:37435
DOE/ET/28466-				
T1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84013687	MN -66	9:37479
DOE/ET/29073-				
T1	NTIS, PC A19/MF A01; 1 (GPO Dep.)	DE84015033	MN -97a	9:37530
DOE/ET/29104-				
1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014166	MN -97c	9:39072
DOE/ET/29136-				
1	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84013606	MN -97	9:37791
DOE/ET/33008-				
T4	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84014431	MN -23	9:37391
DOE/ET/34212-				
41	NTIS (US Sales Only), PC A07/MF A01; 1 (GPO Dep.)	DE84014833	STD -78	9:37564
DOE/ET/52053-				
T1	NTIS, PC A05; 3 (GPO Dep.)	DE84007332	MN -20a	9:39008
DOE/ET/53051-				
68	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014953	STD -20f	9:38932
DOE/EV/02001-				
10	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014896	MN -48	9:38562
DOE/EV/02725-				
T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013286	MN -48	9:38563
DOE/EV/03140-				
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014919	MN -48	9:38615
DOE/EV/10328-				
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015235	MN -48	9:38616
DOE/EV/10403-				
13	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014827	MN -11	9:38386
DOE/EV/10611-				
4	NTIS, PC A07/MF A01 (GPO Dep.)	DE84009713	STD -11	9:38454
DOE/EV/10673-				
T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014632	MN -37	9:38283
DOE/FE/00016-				
T42	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014674	MN -88	9:37139
T52	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014911	MN -88	9:37140
DOE/FE/05114-				
T1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84014060	STD -90	9:37125
DOE/FE/16122-				
1491-Vol.4	NTIS, PC A11/MF A01	DE84002544	STD -90c	9:37415
DOE/FE/55014-				
T9	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015266	STD -90c	9:37044
DOE/FE/60014-				
T1	NTIS, PC A20/MF A01; 1 (GPO Dep.)	DE84012819	MN -90	9:37154
DOE/FE/60177-				
1624	NTIS, PC A04/MF A01 (GPO Dep.)	DE84013369	STD -91	9:37214
DOE/FE/60338-				
9	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015307	MN -93	9:37825
DOE/ID/01570-				
T63	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84011570	MN -70B	9:37267
DOE/ID/12026-				
T6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015189	STD -66b	9:37482

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DOE/ID/12033-T4	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014325	MN -66a	9:37480
DOE/ID/12051-T2	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84014792	MN -66	9:37416
T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014793	MN -66	9:37417
DOE/ID/12167-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015188	STD -66e	9:37487
DOE/ID/12210-T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015139	MN -66e	9:37488
DOE/ID/12380-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015036	MN -25	9:38073
DOE/IR/10283-T3	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84013301	MN -98F	9:37815
DOE/JPL-1012-96	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014599	STD -63b	9:37436
1012-97	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84014963	STD -63b	9:37437
1060-70	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014600	STD -62b	9:37457
1060-73	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014616	STD -62	9:37458
DOE/JPL/956312-07	NTIS, PC A03/MF A01 (GPO Dep.)	DE84015260	STD -63b	9:37438
DOE/JPL/956369-84/ 03	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013757	STD -63b	9:37439
DOE/JPL/956679-84/ 2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015509	STD -63b	9:37440
DOE/JPL/956741-84/ 01	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014762	STD -63b	9:37441
DOE/LLW-18T-Rev.4	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE84014552	STD -70B	9:37268
DOE/MA-0004/ 3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014798	MN -13	9:37772
0064/ 2-Vol.1	NTIS, PC A99/MF A01; 1 (GPO Dep.)	DE84009776	MN -13	9:39051
DOE/MC/14061-1498	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84000222	STD -90c	9:37155
DOE/MC/14517-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015218	MN -92a	9:37205
DOE/MC/15091-1612	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84009256	STD -90i	9:37199
DOE/MC/16050-1601	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009265	STD -90b	9:37045
DOE/MC/16053-1610	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84011799	STD -90c	9:37046
DOE/MC/16242-1554	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84003072	STD -90c	9:37826
DOE/MC/19285-1505-Vol.1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84012005	STD -90i	9:38387
1505-Vol.2-App.	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84012006	STD -90i	9:37810
DOE/MC/20050-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015380	MN -90c	9:37047
DOE/MC/20212-1629	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015166	STD -93	9:37827
DOE/MI/02509-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014430	MN -13	9:37752
DOE/MI/10023-T3	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84013815	MN -13	9:37753
DOE/NASA-0168-7	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015164	MN -96	9:37908
0205-8	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84015759	MN -97d	9:37828
0263-1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015267	STD -96	9:37914
DOE/NASA/20320-59	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015014	STD -60	9:37497
DOE/NBM-4013588	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013588	MN -98F	9:37184
4014070	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014070	MN -96	9:37856
4014200	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84014200	MN -98	9:37185
4014202	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014202	MN -96	9:37857
4014203	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014203	MN -96	9:37858
4014414	Lexington Books, D.C. Heath and Company, Lexington, MA	TI84014414		9:37770
4014686	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014686	MN -20	9:39009
4014917	Noyes Publication, Mill Road, Park Ridge, New Jersey 07656; 1	TI84014917	ND -11	9:38405
DOE/NE-0030/ 11	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015230	MN -80	9:37543
0048/ 6	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015420	MN -80	9:37532
0054	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015422	STD -2	9:37620
SH01	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014829	STD -70A	9:37269
SH03	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014841	STD -70A	9:37270
SH12	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014782	STD -70A	9:37271
DOE/NV/10116-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014622	MN -96	9:37909
DOE/OR/03054-1-Suppl.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015108	STD -89	9:37048
2-Suppl.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015107	STD -89	9:37049
5-Suppl.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015103	STD -89	9:37050
7-Suppl.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015105	STD -89	9:37051
8-Suppl.	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015102	STD -89	9:37052

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17-Suppl.	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015100	STD -89	9:37053
26-Suppl.	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015097	STD -89	9:37054
37-Annex-Vol.A	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84015193	STD -89	9:37055
37-Annex-Vol.B	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84015196	STD -89	9:37056
37-Annex-Vol.C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015197	STD -89	9:37057
37-Annex-Vol.D	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015195	STD -89	9:37058
37-Annex-Vol.E	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015198	STD -89	9:37059
37-Annex-Vol.F	NTIS, PC A03/MF A01 (GPO Dep.)	DE84015199	STD -89	9:37060
37-Vol.1	NTIS, PC A08/MF A01 (GPO Dep.)	DE84015190	STD -89	9:37061
37-Vol.2	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84015194	STD -89	9:37062
66	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014934	STD -89	9:37063
115	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84015160	STD -89	9:37064
122	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015233	STD -89	9:37065
T2-Suppl.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015109	STD -89	9:37066
T14	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84015163	STD -89	9:37067
T15	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015165	STD -89	9:37068
T16-Vol.1	NTIS, PC A23/MF A01; 1 (GPO Dep.)	DE84015162	STD -89	9:37069
DOE/OR/20722-				
4	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84012082	STD -70A	9:37272
7	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015853	STD -70A	9:38429
8	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84013459	STD -70A	9:37273
DOE/PC/30013-				
F10	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84014544	STD -90a	9:37094
DOE/PC/30209-				
T8	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014512	STD -90d	9:37070
T9	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014514	STD -90d	9:37071
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T11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014631	STD -90d	9:37072
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T5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006591	STD -90a	9:38698
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T3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014522	STD -90d	9:37073
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T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014307	MN -90d	9:37074
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3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014695	STD -90d	9:37076
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T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014478	MN -90a	9:37403
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T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014812	MN -90a	9:37156
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T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015038	MN -90a	9:37095
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0054	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015690	STD -92	9:37202
0055	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84014819	STD -41	9:38642
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T14	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013789	MN -96	9:37883
T20	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014210	MN -96	9:37859
T22	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84014220	MN -96	9:37860
T24	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84013848	MN -96	9:37861
T25	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84014212	MN -96	9:37862
T32	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84014190	MN -96	9:37863
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T22	NTIS, PC A04/MF A01 (GPO Dep.)	DE84014187	MN -96	9:37865
T23	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014197	MN -96	9:37866
T24	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84014206	MN -96	9:37867
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84/ 2	NTIS, PC A06/MF A01 (GPO Dep.)	DE84015151	STD -90	9:37418
DOE/PETC/TR-				
84/ 9	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015468	STD -90e	9:37096
DOE/R7/01020-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015238	MN -60	9:37498
DOE/R7/01036-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84007741	MN -59c	9:37469
DOE/R7/01103-				
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015240	MN -59a	9:37470
DOE/R7/01124-				
T1	NTIS, PC A06; 3 (GPO Dep.)	DE84007717	MN -95d	9:37832
DOE/R7/01230-				
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015239	MN -59b	9:37471
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DOE/R8/01018-				
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015418	MN -88	9:37126
DOE/R8/01253-				
T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015441	MN -91	9:37219
DOE/R8/01455-				
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015417	MN -91	9:37210
DOE/R8/03006-				
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015203	MN -61	9:37442
DOE/R8/06037-				
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015793	MN -96	9:37910

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DOE/R8/07012-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015416	MN -61F	9:37419
DOE/R8/07020-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015408	MN -91	9:37220
DOE/RA/08741-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014192	MN -96	9:37884
DOE/RA/50364-T1	NTIS MF A01; 2 (GPO Dep.)	DE84010735	MN -95e	9:37899
DOE/RA/50420-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014161	MN -32	9:39073
DOE/RA/50425-1	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE84014046	MN -97	9:37502
DOE/RL/01830-T22	Noyes Data Corp., Mill Rd., Park Ridge, NJ 07656	TI84014553	ND -95f	9:37894
DOE/RL/10153-T1-Vol.8-Pt.2	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84010913	MN -78	9:37727
DOE/RW-0005-Draft-Vol.1-2	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84015282	MN -70	9:37274
DOE/SF/00515-T34	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014777	MN -28	9:38230
DOE/SF/11564-8	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84012714	STD -92a	9:37175
9	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84012724	STD -92a	9:37173
DOE/SF/11653-T11	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015137	MN -4	9:38055
DOE/SF/11958-T1	NTIS, PC A08; 3 (GPO Dep.)	DE84008564	STD -95e	9:37900
DOE/SF/11972-T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013653	MN -59a	9:37429
DOE/TIC-3367-Suppl.2-Pts.1and2	NTIS	DE83018001	STD -91	9:37211
DP-81-125-4	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84015899	STD -70	9:37275
82-125-2	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015066	STD -70	9:37276
1686	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014925	STD -11	9:38466
DP-MS-83-125	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013962	MN -70	9:37277
83-133	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013957	MN -70	9:37278
DPST-83-270-Rev.1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84014980	MN -41	9:38410
83-665	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014979	MN -80	9:37653
84-338	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014978	MN -80	9:37654
84-494	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014977	MN -70	9:37279
84-526	NTIS, PC A02; 3 (GPO Dep.)	DE84014976	MN -80	9:37655
DPW-75-123	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013960	MN -80	9:37667
EFI-545(32) -82	NTIS (US Sales Only), PC A02/MF A01	DE84701541	MN -28	9:38231
553(40) -82	NTIS (US Sales Only), PC A02/MF A01	DE84701609	MN -37	9:38284
598(85) -82	NTIS (US Sales Only), PC A02/MF A01	DE84701542	MN -28	9:38232
EGG-1183-414	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014780	MN -37	9:38285
1183-446	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014912	MN -32	9:38286
2309	NTIS, PC A05/MF A01 (GPO Dep.)	DE84015231	STD -20e	9:39010
10282-1002	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014678	MN -41	9:38411
10282-2039	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015070	MN -48	9:38440
EGG-ED-6662	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015171	MN -32	9:39074
EGG-FSP-6667	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015170	MN -20d	9:39011
EGG-MS-6614	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015169	MN -70B	9:37280
EGG-PBS-6509	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84015176	MN -22	9:37371
6669	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015173	MN -37	9:38287
EGG-TMI-6588	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014715	MN -86	9:37565
EIR-409	NTIS (US Sales Only), PC A03/MF A01	DE84701521	MN -25	9:37281
469	NTIS (US Sales Only), PC A04/MF A01	DE84701575	MN -80	9:37544
480	NTIS (US Sales Only), PC A03/MF A01	DE84701614	MN -70	9:37282
EMI-E-14/ 77	Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen (Germany, F.R.)			9:37668
EML-419	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015736	STD -11	9:38412
429	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015737	STD -11	9:38430
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EPRI-AP-2739-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920498	ND -90f	9:37792

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3264	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920468	ND -63	9:37454
3551	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920479	ND -90f	9:37793
3572	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920433	ND -66	9:37490
EPRI-CS-				
2894-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920480	ND -90i	9:37108
3504	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920493	ND -90h	9:37929
3543	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920451	ND -90i	9:37109
3544	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920490	ND -90i	9:37110
3544-Vol.2	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920487	ND -90i	9:37111
3544-Vol.3	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920491	ND -90i	9:37112
3548	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920436	ND -90b	9:37150
3565	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920477	ND -90i	9:37113
3612-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920449	ND -90a	9:37528
3615	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920482	ND -90i	9:37114
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3255	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920448	ND -97b	9:37794
3560-CCM-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920455	ND -97b	9:37795
3560-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920456	ND -97b	9:37796
3560-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920426	ND -97b	9:37797
3575	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920462	ND -97b	9:37798
3576	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920492	ND -97c	9:37799
3584	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920459	ND -11	9:38467
3585-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920463	ND -95	9:37901
3585-Vol.2	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920471	ND -95	9:37902
3606-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920439	ND -95	9:37834
3609	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920488	ND -97b	9:37800
3610	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920470	ND -90i	9:37097
EPRI-EL-				
3591-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920452	ND -97b	9:37499
3592-CCM	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920502	ND -97a	9:37531
EPRI-EM-				
3159-SR	NTIS, PC A17/MF A01; 1	DE83902534	MN -94a	9:37729
3453	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920445	ND -94c	9:37736
3534-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920457	ND -97e	9:37424
3534-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920434	ND -97e	9:37425
3534-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920429	ND -97e	9:37428
3534-Vol.4	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920431	ND -97e	9:37426
3582	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920467	ND -95d	9:37835
EPRI-NP-				
2709-CCM-Vol.1-Rev.2	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920489	ND -80	9:37719
2955	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920432	ND -80	9:37669
3041	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920494	ND -78	9:37566
3416	EPRI-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920396	ND -80	9:37533
3470	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920437	ND -80	9:37670
3485	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920425	ND -78	9:37671
3508	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920461	ND -78	9:37567
3509	NTIS, PC A05/MF A01; 1 - EPRI (GPO Dep.)	DE84015209	MN -78	9:37568
3510	NTIS, PC A05/MF A01 - EPRI (GPO Dep.)	DE84015211	MN -78	9:37569
3516	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920496	ND -32	9:38107
3528	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920458	ND -78	9:37545
3539	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920427	ND -80	9:37672
3545	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920446	ND -78	9:37570
3553	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920440	ND -78	9:37673
3555	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920447	ND -78	9:37546
3557	NTIS, PC A04/MF A01 - EPRI (GPO Dep.)	DE84015099	MN -78	9:37571
3558	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920443	ND -78	9:37572
3559	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920464	ND -4	9:37507
3562	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI84920454	ND -78	9:37674
3563	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920442	ND -78	9:37675
3568	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920473	ND -78	9:37547
3569	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920450	ND -78	9:37548
3570	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920460	ND -80	9:37549
3577	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920441	ND -70B	9:37283
3583	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920478	ND -41	9:37676
3590	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920466	ND -78	9:37550
3617	Electric Power Research Institute-Research Reports Center, Box 50490, Palo Alto, CA 94303	TI84920472	ND -70B	9:37284
3630	NTIS, PC A10/MF A01; 1 - EPRI (GPO Dep.)	DE84015098	MN -78	9:37573
EUR-				
4455	*See* ORNL-tr-5153	DE84014814	MN -34C	9:38721
7374	NTIS (US Sales Only), PC A13/MF A01	DE84701615	MN -70	9:37285
7620(Vol.1)	NTIS (US Sales Only), PC A99/MF A01	DE84701618	MN -70	9:37286

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7620(Vol.2)	NTIS (US Sales Only), PC A09/MF A01	DE84701619	MN -70	9:37287
8178	NTIS (US Sales Only), PC A02/MF A01	DE84701620	MN -70	9:37288
8349	NTIS (US Sales Only), PC A03/MF A01	DE84701511	MN -4	9:38012
8482	NTIS (US Sales Only), PC A07/MF A01	DE84701576	MN -80	9:37677
8501	NTIS (US Sales Only), PC A03/MF A01	DE84701517	MN -25	9:37930
8504	NTIS (US Sales Only), PC A04/MF A01	DE84701616	MN -70	9:37678
8574	NTIS (US Sales Only), PC A07/MF A01	DE84701621	MN -70	9:37289
8663	NTIS (US Sales Only), PC A06/MF A01	DE84701617	MN -70	9:37290
8702	NTIS (US Sales Only), PC A10/MF A01	DE84701577	MN -80	9:37679
8707	NTIS (US Sales Only), PC A03/MF A01	DE84701631	MN -32	9:39075
8747	NTIS (US Sales Only), PC A07/MF A01	DE84701622	MN -70	9:37291
8959-EN	Commission of the European Communities, Luxembourg			9:37740
8965-EN	Commission of the European Communities, Luxembourg			9:37741
8972-EN	Commission of the European Communities, Luxembourg			9:37742
FE-				
2013-28	*See* DOE/PC/40781-T11	DE84014631	STD -90d	9:37072
2468-110	*See* DOE/ET/10679-T23	DE84014787	MN -90	9:37040
2468-112	*See* DOE/ET/10679-T22	DE84014477	MN -90	9:37039
2631-13	*See* DOE/ET/10682-13	DE84015342	MN -90h	9:37041
FEI-				
1306	NTIS (US Sales Only), PC A02/MF A01	DE84701540	MN -38	9:38911
1392	NTIS (US Sales Only), PC A02/MF A01	DE84701583	MN -80	9:37649
FERMILAB/TM-				
1269	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015324	MN -28	9:38192
1271	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015326	MN -28	9:38233
FRNC-TH-				
1454	NTIS (US Sales Only), PC A05/MF A01	DE84751588	MN -34C	9:38833
FWC/FWDC/TR-				
84/ 17	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84013997	STD -90b	9:37098
FWS/OBS-				
80/ 40.16	NTIS, PC A06/MF A01; 1	DE84901178	MN -11	9:38617
84/ 04	NTIS, PC A07/MF A01; 1	DE84901686	MN -11	9:38422
GA-A-				
17199	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013554	MN -20	9:39012
17203	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013557	MN -20	9:39013
17204	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013555	MN -20	9:39014
17205	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013654	MN -20	9:39015
17225	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013556	MN -20	9:39016
17557	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013840	MN -20a	9:39017
17576	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013841	MN -20d	9:38933
17585	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013842	MN -20a	9:39018
17634	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014693	MN -83	9:37292
17645	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014883	MN -20g	9:38934
GA-C-				
17227	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84014897	MN -22	9:37225
GAO/RCED-				
84-78	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760	TI84901685	MN -92a	9:37189
GCA-TR-				
82-60-G(2)	*See* PB-84-187806			9:38393
GEND-				
026	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84014877	STD -78	9:37574
GEND-INF-				
013	NTIS PC E04/MF $4.75; 1 (GPO Dep.)	DE84014736	MN -78	9:37575
031-Vol.2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015257	MN -78	9:37576
GJBX-				
5(84)	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE84014974	MN -51	9:37223
GL-				
3582	*See* AD-A-138198/7			9:38125
GPO-				
12-821	*See* N-8330236			9:39025
GRI-				
84/ 0090	*See* SAND-84-0247	DE84015691	MN -92a	9:37207
GRS-A-				
810	*See* BMI-1983-024	DE84751841	MN -80	9:37660
GSF-BT-				
789	Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig, Germany, F.R., Inst. fuer Tieflagerung	TI84751940	MN -48	9:38510
HEDL-SA-				
3002-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014649	MN -79	9:37635
3031-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014647	MN -25	9:37931
3047-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014648	MN -79	9:37650
3058-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014556	MN -79b	9:37680
3129-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014644	MN -32	9:39076
HEDL-TME-				
84-14	*See* NUREG/CR-3658	TI84015220	MN -86	9:37248
HIG-				
83-3	NTIS, PC A07/MF A01; 1	DE84901453	MN -11	9:38651
IAE-				
3683/ 7	NTIS (US Sales Only), PC A02/MF A01	DE84702539	MN -20	9:38935
IC-				
83/ 93	NTIS (US Sales Only), PC A02/MF A01	DE84702537	MN -34A	9:38902
83/ 113	NTIS (US Sales Only), PC A02/MF A01	DE84702536	MN -34A	9:38903

Report No.	Availability	Order No.	Distribution Category	Abstract No.
IEA/EAS-				
E5	NTIS (US Sales Only), PC A04/MF A01	DE84901382	STD -90d	9:38056
IEAL-R-				
84-7-Vol.1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84015317	MN -70	9:37357
84-7-Vol.2	NTIS, PC A04/MF A01 (GPO Dep.)	DE84015347	MN -70	9:37358
84-24-Vol.1	NTIS, PC A05/MF A01 (GPO Dep.)	DE84015329	MN -70	9:37294
84-24-Vol.2	NTIS, PC A05/MF A01 (GPO Dep.)	DE84014773	MN -70	9:37295
IFVE-OI-				
82-178	NTIS (US Sales Only), PC A02/MF A01	DE84701543	MN -28	9:38164
83-9	NTIS (US Sales Only), PC A02/MF A01	DE84701544	MN -28	9:38193
IFVE-OMVT-				
82-196	NTIS (US Sales Only), PC A02/MF A01	DE84701545	MN -28	9:38194
83-2	NTIS (US Sales Only), PC A02/MF A01	DE84701546	MN -28	9:38195
IFVE-ORI-				
82-168	NTIS (US Sales Only), PC A02/MF A01	DE84701547	MN -28	9:38196
IFVE-OUNK-				
82-133	NTIS (US Sales Only), PC A02/MF A01	DE84701548	MN -28	9:38197
82-135	NTIS (US Sales Only), PC A02/MF A01	DE84701549	MN -28	9:38198
82-167	NTIS (US Sales Only), PC A02/MF A01	DE84701550	MN -28	9:38199
IKE-				
5TF-538-82	Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (Germany, F.R.)			9:38352
INIS-mf-				
8390	NTIS (US Sales Only), PC A06/MF A01	DE84780258	MN -34C	9:38816
8394	NTIS (US Sales Only), PC A03/MF A01	DE84780264	MN -34B	9:38034
8718	NTIS (US Sales Only), PC A05/MF A01	DE84780259	MN -34C	9:38829
8731	NTIS (US Sales Only), PC A06/MF A01	DE84780261	MN -86	9:37296
8963	NTIS (US Sales Only), PC A02/MF A01	DE84701629	MN -2	9:37767
8964	NTIS (US Sales Only), PC A02/MF A01	DE84701623	MN -70	9:37314
8970	NTIS (US Sales Only), PC A02/MF A01	DE84780476	MN -34C	9:38830
8971	NTIS (US Sales Only), PC A02/MF A01	DE84780473	MN -34A	9:38701
8977	NTIS (US Sales Only), PC A08/MF A01	DE84780481	MN -2	9:39097
8981	NTIS (US Sales Only), PC A04/MF A01	DE84780475	MN -34C	9:38293
8987	NTIS (US Sales Only), PC A02/MF A01	DE84780478	MN -70	9:37341
8988	NTIS (US Sales Only), PC A07/MF A01	DE84780479	MN -70	9:37342
8989	NTIS (US Sales Only), PC A07/MF A01	DE84780480	MN -70	9:37343
9000	NTIS (US Sales Only), PC A05/MF A01	DE84780477	MN -51	9:37224
9005	NTIS (US Sales Only), PC A07/MF A01	DE84780512	MN -46	9:38896
9006	NTIS (US Sales Only), PC A18/MF A01	DE84780511	MN -34D	9:38704
9033	NTIS (US Sales Only), PC A02/MF A01	DE84780534	MN -2	9:37768
INIS-SU-				
236	NTIS (US Sales Only), PC A11/MF A01	DE84780474	MN -34A	9:38808
238	NTIS (US Sales Only), PC A04/MF A01	DE84780472	MN -34A	9:38706
INPE-				
2260	NTIS (US Sales Only), PC A03/MF A01	DE84702565	MN -34B	9:38687
IPPJ-				
629	*See* N-8329049			9:39024
IPT-				
1225	NTIS (US Sales Only), PC A08/MF A01	DE84702563	MN -51	9:37643
IS-				
4557	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014878	MN -15	9:37359
4842	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015018	MN -90	9:37885
4844	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014876	MN -20e	9:38016
4845	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84014873	MN -80	9:37626
4846	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015019	MN -90	9:37886
4849	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014871	MN -11	9:38353
4850	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015060	MN -25	9:37965
4853	NTIS, PC A04/MF A01 (GPO Dep.)	DE84015020	MN -90	9:37887
4855	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014870	MN -25	9:37472
4856	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015007	STD -90e	9:38354
4859	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014869	MN -11	9:38355
4860	NTIS, PC A03/MF A01 (GPO Dep.)	DE84015006	MN -90	9:37888
IS-M-				
494	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014820	MN -80	9:37627
IS-RIC-PR-				
7	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84015057	MN -4	9:37936
8	NTIS, PC A06/MF A01 (GPO Dep.)	DE84014880	MN -4	9:37937
ITEF-				
92(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84701612	MN -37	9:38154
108(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84701632	MN -32	9:39077
114(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84701633	MN -32	9:39078
115(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84702559	MN -4	9:38089
134(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84702547	MN -34D	9:38744
150(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84701634	MN -32	9:39079
151(1982)	NTIS (US Sales Only), PC A02/MF A01	DE84701635	MN -32	9:37681
ITEP-				
114(1983)	NTIS (US Sales Only), PC A03/MF A01	DE84702550	MN -34C	9:38815
JEN-				
551	NTIS (US Sales Only), PC A04/MF A01	DE84702577	MN -32	9:39095
JINR-				
1-83-27	NTIS (US Sales Only), PC A02/MF A01	DE84701602	MN -37	9:38297
1-83-105	NTIS (US Sales Only), PC A02/MF A01	DE84701561	MN -28	9:38202
1-83-185	NTIS (US Sales Only), PC A02/MF A01	DE84701600	MN -37	9:38298
1-83-256	NTIS (US Sales Only), PC A02/MF A01	DE84701601	MN -37	9:38299
1-83-274	NTIS (US Sales Only), PC A02/MF A01	DE84701637	MN -32	9:38300

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6-82-624	NTIS (US Sales Only), PC A02/MF A01	DE84701640	MN -32	9:38301
9-83-115	NTIS (US Sales Only), PC A02/MF A01	DE84701563	MN -28	9:38237
9-83-144	NTIS (US Sales Only), PC A02/MF A01	DE84701564	MN -28	9:38203
9-83-289	NTIS (US Sales Only), PC A02/MF A01	DE84701565	MN -28	9:38204
9-83-311	NTIS (US Sales Only), PC A02/MF A01	DE84701566	MN -28	9:38238
9-83-317	NTIS (US Sales Only), PC A02/MF A01	DE84701567	MN -28	9:38167
9-83-335	NTIS (US Sales Only), PC A02/MF A01	DE84701568	MN -28	9:38205
9-83-416	NTIS (US Sales Only), PC A02/MF A01	DE84701569	MN -28	9:38239
10-82-641	NTIS (US Sales Only), PC A02/MF A01	DE84701638	MN -32	9:38302
10-82-931	NTIS (US Sales Only), PC A02/MF A01	DE84701639	MN -32	9:38303
10-83-276	NTIS (US Sales Only), PC A02/MF A01	DE84701608	MN -37	9:38812
10-83-362	NTIS (US Sales Only), PC A02/MF A01	DE84701613	MN -37	9:38813
10-83-382	NTIS (US Sales Only), PC A02/MF A01	DE84701562	MN -28	9:38240
12-82-831	NTIS (US Sales Only), PC A02/MF A01	DE84701507	MN -4	9:38017
12-82-851	NTIS (US Sales Only), PC A02/MF A01	DE84701514	MN -4	9:38098
12-82-852	NTIS (US Sales Only), PC A02/MF A01	DE84701515	MN -4	9:38018
13-83-35	NTIS (US Sales Only), PC A02/MF A01	DE84701605	MN -37	9:38304
13-83-188	NTIS (US Sales Only), PC A02/MF A01	DE84701603	MN -37	9:38305
13-83-342	NTIS (US Sales Only), PC A02/MF A01	DE84701604	MN -37	9:38306
16-83-240	NTIS (US Sales Only), PC A02/MF A01	DE84701606	MN -37	9:38307
18-82-340	NTIS (US Sales Only), PC A02/MF A01	DE84701508	MN -4	9:38019
18-83-53	NTIS (US Sales Only), PC A02/MF A01	DE84701535	MN -41	9:38897
18-83-292	NTIS (US Sales Only), PC A02/MF A01	DE84701610	MN -37	9:38356
19-83-257	NTIS (US Sales Only), PC A02/MF A01	DE84701525	MN -48	9:38585
D-1-82-642	NTIS (US Sales Only), PC A02/MF A01	DE84701584	MN -37	9:38308
E-2-83-126	NTIS (US Sales Only), PC A02/MF A01	DE84702540	MN -34D	9:38791
E-2-83-533	NTIS (US Sales Only), PC A02/MF A01	DE84702541	MN -34D	9:38767
E-2-83-615	NTIS (US Sales Only), PC A02/MF A01	DE84702542	MN -34D	9:38768
E-4-83-574	NTIS (US Sales Only), PC A02/MF A01	DE84702551	MN -34C	9:38822
E-5-82-855	NTIS (US Sales Only), PC A02/MF A01	DE84701585	MN -37	9:38311
R-1-83-390	NTIS (US Sales Only), PC A02/MF A01	DE84701586	MN -37	9:38312
R-1-83-434	NTIS (US Sales Only), PC A02/MF A01	DE84701607	MN -37	9:38313
R-5-82-662	NTIS (US Sales Only), PC A02/MF A01	DE84701597	MN -37	9:38314
R-5-82-663	NTIS (US Sales Only), PC A02/MF A01	DE84701598	MN -37	9:38315
R-5-82-879	NTIS (US Sales Only), PC A02/MF A01	DE84701552	MN -28	9:38214
R-6-82-859	NTIS (US Sales Only), PC A02/MF A01	DE84701513	MN -4	9:38099
R-7-83-332	NTIS (US Sales Only), PC A06/MF A01	DE84701599	MN -37	9:38316
R-8-83-159	NTIS (US Sales Only), PC A02/MF A01	DE84701553	MN -28	9:38357
R-9-82-652	NTIS (US Sales Only), PC A02/MF A01	DE84701554	MN -28	9:38215
R-9-82-925	NTIS (US Sales Only), PC A02/MF A01	DE84701555	MN -28	9:38216
R-9-83-13	NTIS (US Sales Only), PC A02/MF A01	DE84701557	MN -28	9:38243
R-9-83-54	NTIS (US Sales Only), PC A03/MF A01	DE84701560	MN -28	9:38244
R-9-83-123	NTIS (US Sales Only), PC A02/MF A01	DE84701556	MN -28	9:38217
R-9-83-193	NTIS (US Sales Only), PC A02/MF A01	DE84701558	MN -28	9:38176
R-9-83-307	NTIS (US Sales Only), PC A02/MF A01	DE84701559	MN -28	9:38177
R-10-82-653	NTIS (US Sales Only), PC A02/MF A01	DE84701636	MN -32	9:38317
R-10-83-370	NTIS (US Sales Only), PC A02/MF A01	DE84701587	MN -37	9:38318
R-12-82-539	NTIS (US Sales Only), PC A02/MF A01	DE84701512	MN -4	9:38057
R-12-83-66	NTIS (US Sales Only), PC A02/MF A01	DE84701516	MN -4	9:38461
R-13-82-637	NTIS (US Sales Only), PC A02/MF A01	DE84701588	MN -37	9:38319
R-13-83-121	NTIS (US Sales Only), PC A02/MF A01	DE84701589	MN -37	9:38358
R-13-83-143	NTIS (US Sales Only), PC A02/MF A01	DE84701590	MN -37	9:38320
R-13-83-145	NTIS (US Sales Only), PC A02/MF A01	DE84701591	MN -37	9:38321
R-13-83-152	NTIS (US Sales Only), PC A02/MF A01	DE84701592	MN -37	9:38322
R-13-83-154	NTIS (US Sales Only), PC A02/MF A01	DE84701593	MN -37	9:38323
R-13-83-183	NTIS (US Sales Only), PC A02/MF A01	DE84701594	MN -37	9:38324
R-13-83-184	NTIS (US Sales Only), PC A02/MF A01	DE84701551	MN -28	9:38245
R-13-83-198	NTIS (US Sales Only), PC A02/MF A01	DE84701595	MN -37	9:38325
R-13-83-419	NTIS (US Sales Only), PC A02/MF A01	DE84701596	MN -37	9:38326
R-16-83-341	NTIS (US Sales Only), PC A02/MF A01	DE84701539	MN -23	9:38246
JPL-PUB-				
84-34	*See* DOE/JPL-1012-97	DE84014963	STD -63b	9:37437
Juel-				
1873	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751933	MN -25	9:37966
1877	NTIS (US Sales Only), PC A08/MF A01; 1	DE84751941	MN -11	9:38388
1882	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751909	MN -59a	9:37473
Juel-Spez-				
233	NTIS (US Sales Only), PC A07/MF A01; 1	DE84751939	MN -13	9:37816
K/D-				
5573-Rev.1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015354	MN -41	9:38618
KAERI/RR-				
352/ 82	NTIS (US Sales Only), PC A09/MF A01	DE84780329	MN -23	9:38588
386-1/ 82	NTIS (US Sales Only), PC A14/MF A01	DE84780327	MN -11	9:38432
386/ 82	NTIS (US Sales Only), PC A19/MF A01	DE84780328	MN -48	9:38435
KFK-				
3621	NTIS (US Sales Only), PC A11/MF A01	DE84780151	MN -34C	9:38809
3655	NTIS (US Sales Only), PC A06/MF A01	DE84751910	MN -4	9:38074
KFTI-				
82-44	NTIS (US Sales Only), PC A02/MF A01	DE84701570	MN -28	9:38218
82-46	NTIS (US Sales Only), PC A03/MF A01	DE84701571	MN -28	9:38178
83-13	NTIS (US Sales Only), PC A03/MF A01	DE84701572	MN -28	9:38247
83-28	NTIS (US Sales Only), PC A02/MF A01	DE84701611	MN -37	9:38327
KIYI-				
82-17	NTIS (US Sales Only), PC A02/MF A01	DE84701509	MN -4	9:38020

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KLR-				
81-48-C	NTIS (US Sales Only), PC A04/MF A01; 1	DE84751908	MN -25	9:37938
LA-				
9445-PNTX-C	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008062	MN -11	9:38415
9445-PNTX-E	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008064	MN -11	9:38591
9445-PNTX-F	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008065	MN -11	9:38592
9445-PNTX-G	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008066	MN -11	9:38389
9445-PNTX-H	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008067	MN -11	9:38462
9445-PNTX-I	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008068	MN -11	9:38645
9445-PNTX-J	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008069	MN -11	9:38476
9445-PNTX-K	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008070	MN -11	9:37811
9445-PNTX-M	NTIS, PC A04/MF A01 (GPO Dep.)	DE84008072	MN -11	9:38436
9445-PNTX-N	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008073	MN -11	9:37344
9445-PNTX-O	NTIS, PC A05/MF A01 (GPO Dep.)	DE84008074	MN -11	9:38593
9445-PNTX-P	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008075	MN -11	9:38559
9445-PNTX-Q	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008076	MN -11	9:38594
9667-MS	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84015058	STD -70	9:37345
9961-T	NTIS, PC A06; 3 (GPO Dep.)	DE84015704	MN -45	9:38367
9964-Vol.1	NTIS, PC A07/MF A01 (GPO Dep.)	DE84015072	STD -15	9:37360
9964-Vol.2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015048	STD -15	9:37361
9973-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015705	MN -45	9:38368
9994-MS	NTIS, PC A05/MF A01 (GPO Dep.)	DE84015055	STD -41	9:38595
10023	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015073	STD -33A	9:37392
10056-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015068	STD -38	9:38115
10079-MS	*See* NUREG/CR-3735	DE84014113	MN -41	9:38418
10099-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013864	STD -98F	9:37812
10101-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015049	STD -70	9:37315
10103-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015071	STD -32	9:38261
10104-M	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84015067	STD -32	9:39080
10114-PR	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84015065	STD -80	9:37622
10118-SR	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015052	STD -28	9:38262
10121-PR	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015075	STD -70	9:37346
10125-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015158	STD -11	9:37316
10126-PR	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015074	STD -33A	9:37393
10128-MS	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84015088	STD -66b	9:37483
10134-PR	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015064	STD -33A	9:37394
10141-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015093	STD -32	9:39081
10142-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015085	STD -32	9:39082
10143-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015047	STD -32	9:39083
10144-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015086	STD -32	9:39084
10145-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015091	STD -32	9:39085
LA-tr-				
84-9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013346	MN -37	9:38365
84-17	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84015059	MN -48	9:38497
84-29	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015350	MN -11	9:38640
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84-1794	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013893	MN -25	9:37967
84-1921	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013907	MN -28	9:38263
84-1938	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014044	MN -20	9:39019
84-1939	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014043	MN -21	9:39020
84-1976	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014033	MN -20f	9:38937
84-2023	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014024	MN -20g	9:39021
84-2038	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014022	MN -45	9:38369
LBL-				
4235	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015339	MN -28	9:38264
17086	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014587	MN -28	9:38265
17429	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014610	MN -95d	9:37836
17442	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014585	MN -25	9:37939
17657	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013885	STD -21	9:39022
17683	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014591	MN -95d	9:37837
17685	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013239	MN -28	9:38266
17788	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013395	MN -21	9:39023
17789	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014608	MN -4	9:37404
17798	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84014572	MN -4	9:38058
17805	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014532	MN -34D	9:38219
17816	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014575	MN -94d	9:37730
17829	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013396	MN -28	9:38267
17852	NTIS, PC A02/MF A01 (GPO Dep.)	DE84014588	MN -4	9:38035
17859	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014581	MN -66	9:37484
17867	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014593	MN -34D	9:38734
17886	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014570	MN -70	9:37317
17935	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014609	MN -34C	9:38268
17976	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014576	MN -20g	9:38938
17990	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014594	MN -34C	9:38185
18026	NTIS, PC A02; 3 (GPO Dep.)	DE84014583	MN -28	9:38186
LBL-PUB-				
473-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014607	MN -95d	9:37838
LMSC-D-				
913086	*See* AD-A-138288/6			9:38374
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2	NTIS (US Sales Only), PC A02/MF A01	DE84701624	MN -70	9:37318
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81-038WP	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008887	MN -98B	9:37179
84-002	*See* PB-84-194208			9:38421

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MITSG-				
83-7	*See* Grant Marine Information Center, MIT Sea Grant College Program., Cambridge, MA 02139	TI84901435	MN -92a	9:38157
MLM-MU-				
80-62-0023	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014800	MN -38	9:38148
MPI-PAE-Exp.El.-				
126	Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik			9:38754
N-				
8328019	NTIS, PC A07			9:38664
8328878	NTIS, PC A02/MF A01			9:38916
8328971	NTIS, PC A02/MF A01			9:37141
8329049	NTIS, PC A03/MF A01			9:39024
8329151	NTIS, PC A02/MF A01			9:38665
8329152	NTIS, PC A02/MF A01			9:38666
8329153	NTIS, PC A04/MF A01			9:38667
8329154	NTIS, PC A03/MF A01			9:38668
8329155	NTIS, PC A03/MF A01			9:38669
8329157	NTIS, PC A03/MF A01			9:38670
8329158	NTIS, PC A03/MF A01			9:38671
8329162	NTIS, PC A05/MF A01			9:38672
8329169	NTIS, PC A02/MF A01			9:38888
8329894	NTIS, PC A08/MF A01			9:38652
8330016	NTIS, PC A05/MF A01			9:38380
8330023	NTIS, PC A05/MF A01			9:38619
8330026	NTIS, PC A05/MF A01			9:38620
8330032	NTIS, PC A05/MF A01			9:38554
8330059	NTIS, PC A03/MF A01			9:38156
8330061	NTIS, PC A06/MF A01			9:37868
8330095	NTIS, PC A03/MF A01			9:38688
8330172	NTIS, PC A02/MF A01			9:38707
8330173	NTIS, PC A02/MF A01			9:38708
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8330336	NTIS, PC A03/MF A01			9:38673
8330344	NTIS, PC A04/MF A01			9:38674
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8330351	NTIS, PC A04/MF A01			9:38678
NASA-CP-				
2133	*See* AD/A-088701	TI84900879	MN -38	9:38112
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NASA-CR-				
166061	*See* N-8330061			9:37868
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174629	*See* DOE/NASA-0168-7	DE84015164	MN -96	9:37908
174659	*See* DOE/NASA-0263-1	DE84015267	STD -96	9:37914
174660	*See* DOE/NASA-0205-8	DE84015759	MN -97d	9:37828
NASA-TM-				
77106	*See* N-8330173			9:38708
77107	*See* N-8330172			9:38707
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2178	*See* N-8329169			9:38888
NBSIR-				
84-3000	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE84013487	STD -20c	9:39026
84-3003	*See* PB-84-192954			9:38116
NCB-P-				
1	NTIS (US Sales Only), PC A02/MF A01	DE84701627	MN -2	9:37786
NCEL-TN-				
1685	*See* AD-A-140146/2			9:37453
NCRP-				
76	NCRP Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814	TI84901624	ND -41	9:38416
NDRL-				
2574	*See* DOE/ER/00038-2574	DE84014938	MN -4	9:38087

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NIIAR-				
2(567)	NTIS (US Sales Only), PC A02/MF A01	DE84701582	MN -79	9:37602
14(529)	NTIS (US Sales Only), PC A02/MF A01	DE84701537	MN -22	9:38090
23(588)	NTIS (US Sales Only), PC A02/MF A01	DE84701519	MN -25	9:37940
28(543)	NTIS (US Sales Only), PC A02/MF A01	DE84701520	MN -25	9:37941
48(563)	NTIS (US Sales Only), PC A02/MF A01	DE84701518	MN -25	9:38036
NIPER-				
135-PPS-84/ 3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84012718	STD -92b	9:37194
NLCO-				
2004	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84014921	MN -16	9:37362
2018	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84015465	MN -41	9:38417
NMERDI-				
2-67-2430	NTIS, PC A03/MF A01	DE84901511	MN -58	9:37430
2-68-2421	*See* NMERDI-2-67-2430	DE84901511	MN -58	9:37430
NNC-P-				
1	NTIS (US Sales Only), PC A05/MF A01	DE84701581	MN -78	9:37585
NOAA-TM-ERL-ARL-				
126	*See* PB-84-183292			9:38420
NP-				
4770417	NTIS (US Sales Only), PC A04/MF A01; 1	DE84770417	MN -4	9:37395
4770418	NTIS (US Sales Only), PC A02; 3	DE84770418	MN -13	9:37743
4770419	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770419	MN -13	9:37744
4770420	NTIS (US Sales Only), PC A02; 3	DE84770420	MN -13	9:37745
4770421	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770421	MN -13	9:37746
4770422	NTIS (US Sales Only), PC A12/MF A01; 1	DE84770422	MN -94a	9:37731
4770423	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770423	MN -13	9:37747
4770424	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770424	MN -13	9:37748
4770425	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770425	MN -38	9:38144
4770426	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770426	MN -13	9:37773
4770427	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770427	MN -97	9:37801
4770428	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770428	MN -13	9:37749
4770429	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770429	MN -94c	9:37737
4770430	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770430	MN -61G	9:37443
4770431	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770431	MN -94a	9:37732
4901555	Tennessee Dept. of Economic and Community Development, Suite 207, 510 Gay St., Nashville 37219	TI84901555	MN -98	9:37750
4901581	Mineral Resources Inst., Univ. of Alabama, P.O. Box AY, University, AL 35486	TI84901581	MN -90	9:37035
4901582	Mineral Resources Inst., Univ. of Alabama, P.O. Box AY, University, AL 35486	TI84901582	MN -90	9:37036
NPL-				
978	NTIS, PC A03/MF A01 (GPO Dep.)	DE84015129	MN -34D	9:38879
NRC-				
4901153-Rev.1	NTIS, PC A02/MF A01; 1 - GPO*	TI84901153	MN -16	9:37363
4901380	NTIS, PC A09/MF A01; 1 - GPO	TI84901380	MN -80	9:37605
NRL-MR-				
5281	*See* AD-A-140209/8			9:38190
5306	*See* AD-A-140208/0			9:38662
NUREG-				
0020-Vol.8-No.5	NTIS, PC A17/MF A01; 1 - GPO*	TI84901551	MN -80	9:37534
0040-Vol.8-No.2	NTIS, PC A19/MF A01; 1 - GPO*	TI84901745	MN -80	9:37535
0304-Vol.9-No.1	NTIS, PC A07/MF A01; 1 - GPO*	DE84901444	MN -2	9:37606
0525-Rev.9	NTIS, PC A04/MF A01; 1 - GPO $4.25	TI84901542	MN -80	9:37364
0540-Vol.6-No.4	NTIS, PC A99/MF A01; 1 - GPO*	DE84901513	MN -2	9:37607
0675-Suppl.23	NTIS, PC A03/MF A01 - GPO* $3.75	TI84901474	MN -78	9:37684
0675-Suppl.24	NTIS, PC A02/MF A01 - GPO $3.00	TI84901675	MN -78	9:37685
0675-Suppl.26	NTIS, PC A10/MF A01; 1 - GPO* $6.50	TI84901744	MN -78	9:37686
0680-Suppl.5	NTIS, PC A16/MF A01; 1 - GPO $6.00	TI84901483	MN -78	9:37687
0725-Rev.4	NTIS, PC A05/MF A01; 1 - GPO* $7.00	TI84901643	MN -71	9:37247
0748-Vol.4-No.5	NTIS, PC A17/MF A01 - GPO*	DE84901550	MN -80	9:37608
0748-Vol.4-No.6	NTIS, PC A17/MF A01 - GPO*	DE84901784	MN -80	9:37609
0750-Vol.19-No.1	NTIS, PC A21/MF A01 - GPO*	TI84901433	MN -2	9:37610
0750-Vol.19-No.2	NTIS, PC A04/MF A01 - GPO	DE84901476	MN -2	9:37611
0787-Suppl.6	NTIS, PC A08/MF A01; 1 - GPO $6.00	TI84901477	MN -78	9:37688
0828-Final	NTIS, PC A99/MF A01; 1 - GPO $14.00	DE84901343	MN -80	9:37689
0871-Vol.3-No.1	NTIS, PC A04/MF A01 - GPO	TI84901292	MN -80	9:37612
0936-Vol.3-No.2	NTIS, PC A09/MF A01 - GPO*	TI84901508	MN -2	9:37613
0954-Suppl.2	NTIS, PC A07/MF A01; 1 - GPO $5.50	TI84901583	MN -78	9:37690
0954-Suppl.3	NTIS, PC A07/MF A01 - GPO* $5.50	TI84901646	MN -78	9:37691
0980	NTIS, PC A99/MF A01 - GPO* $11.00	TI84901420	MN -2	9:37614
1038-Suppl.1	NTIS, PC A04/MF A01; 1 - GPO* $4.50	TI84901543	MN -78	9:37692
1052	NTIS, PC A04/MF A01; 1 - GPO $4.50	TI84901455	MN -11	9:37615
1058	NTIS, PC A21/MF A01 - GPO*	TI84901442	MN -80	9:37616
1063	NTIS, PC A03/MF A01; 1 - GPO $4.25	TI84901445	MN -78	9:37586
1064	NTIS, PC A15/MF A01 - GPO* $8.00	DE84901636	MN -78	9:37644
1072-App.A	NTIS, PC A23/MF A01 - GPO* $10.00	TI84901669	MN -78	9:37587
1075	NTIS, PC A02/MF A01 - GPO* $3.25	TI84901673	MN -80	9:37617
1077	NTIS, PC A06/MF A01; 1 - GPO $5.00	TI84901299	MN -11	9:38478
1078	NTIS, PC A05/MF A01; 1 - GPO $4.50	TI84901300	MN -11	9:38479
NUREG/BR-				
0025-Vol.10-No.3	NTIS, PC A02/MF A01 - GPO*	DE84901256	MN -2	9:37319
0025-Vol.10-No.4	NTIS, PC A02/MF A01 - GPO*	TI84901553	MN -2	9:37618
0051-Vol.6-No.1	NTIS, PC A04/MF A01; 1 - GPO	TI84901598	MN -80	9:37693
NUREG/CP-				
0048-Vol.3	NTIS, PC A99/MF A01; 1 - GPO* $12.00	DE84900511	MN -78	9:37694

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NUREG/CR-				
2000-Vol.3-No.6	NTIS, PC A05/MF A01; 1 - GPO	TI84014886	MN -80	9:37711
2331-Vol.3-No.3	NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.)	DE84011672	MN -78	9:37712
3054	NTIS, PC A04/MF A01 - GPO* $4.50	TI84901479	MN -78	9:37645
3134	NTIS, PC A06/MF A01; 1 - GPO	TI84015027	MN -80	9:37713
3346	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE84013065	MN -41	9:38596
3427-Vol.4	NTIS, PC A13/MF A01 - GPO* $7.00	TI84901512	MN -70	9:37320
3470	NTIS, PC A11/MF A01; 1 - GPO	TI84014964	MN -78	9:37714
3520-Vol.1	NTIS, PC A03/MF A01; 1 - GPO	TI84014971	MN -15	9:37558
3520-Vol.2	NTIS, PC A10/MF A01; 1 - GPO	TI84014972	MN -80	9:37536
3583	NTIS, PC A05/MF A01; 1 - GPO	TI84901584	MN -11	9:38441
3599	NTIS, PC A07/MF A01 - GPO (GPO Dep.)	DE84013437	MN -38	9:38108
3658	NTIS, PC A03/MF A01 - GPO $3.75	TI84015220	MN -86	9:37248
3714	NTIS, PC A04/MF A01 - GPO (GPO Dep.)	DE84014402	MN -70	9:37321
3735	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	DE84014113	MN -41	9:38418
3744-Vol.1	NTIS, PC A09/MF A01 - GPO (GPO Dep.)	DE84012948	MN -78	9:37631
3775	NTIS, PC A08/MF A01; 1 - GPO $5.50	TI84901287	MN -41	9:37354
3825-Vol.1-2	NTIS, PC A03/MF A01; 1 - GPO $4.00	DE84015039	MN -80	9:37559
3838	NTIS, PC A02/MF A01; 1 - GPO* $3.25	TI84901535	MN -70B	9:37347
3840	NTIS, PC A08/MF A01; 1 - GPO* $5.50	TI84901746	MN -78	9:37560
3848	NTIS, PC A05/MF A01; 1 - GPO $4.50	TI84901565	MN -11	9:38151
3849	NTIS, PC A04/MF A01 - GPO* $4.25	TI84901536	MN -78	9:37715
ORAU-				
227	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84015054	MN -13	9:37537
ORNL-				
6006	*See* NUREG/CR-3714	DE84014402	MN -70	9:37321
ORNL/NSIC-				
200-Vol.3-No.6	*See* NUREG/CR-2000-Vol.3-No.6	TI84014886	MN -80	9:37711
ORNL/Sub-				
82-22252/ 2	*See* NUREG/CR-3599	DE84013437	MN -38	9:38108
83-13876/ 1	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84013552	MN -95f	9:37889
ORNL/TM-				
8795	*See* NUREG/CR-3346	DE84013065	MN -41	9:38596
8896	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84013567	STD -95	9:37905
8902	*See* NUREG/CR-3470	TI84014964	MN -78	9:37714
9139	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013604	MN -70	9:37322
9154/ Vol.1	*See* NUREG/CR-3744-Vol.1	DE84012948	MN -78	9:37631
ORNL-tr-				
5139	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013746	MN -20b	9:39048
5153	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84014814	MN -34C	9:38721
OSS/RR-				
1	NTIS (US Sales Only), PC A03/MF A01	DE84702566	MN -41	9:38445
OSS/TM-				
4	NTIS (US Sales Only), PC A02/MF A01	DE84702567	MN -41	9:38446
P-				
300-83-013	California Energy Commission, 1516-19th Street, Sacramento, CA 95814	TI84901648	MN -96	9:37869
400-83-004	California Energy Commission, 1516-9th Street, Sacramento, CA 95814	TI84901647	MN -96	9:37870
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4,430,042				9:37489
A 6-488,311		DE84014516	MN -48	9:38549
A 6-541,186		DE84014663	MN -70	9:37339
A 6-541,188		DE84014661	MN -38	9:37972
A 6-547,280		DE84014243	MN -4	9:38029
A 6-547,681		DE84014244	MN -80	9:37632
A 6-559,504		DE84014446	MN -62b	9:37449
PB-				
84-135797	NTIS, PC A11/MF A01			9:38442
84-149699	NTIS, PC A08/MF A01			9:38473
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ORDER NUMBER CORRELATION

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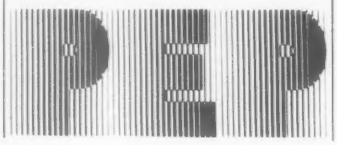

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